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NEW TAXA AND GEOGRAPHIC VARIATION OF WESTERN NORTH AMERICAN BUTTERFLIES, BASED ON SPECIMENS IN THE C. P. GILLETTE MUSEUM OF ARTHROPOD DIVERSITY, COLORADO STATE UNIVERSITY

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During the two winters of 2016-2017, Scott volunteered to curate the butterflies in the C. P. Gillette Museum of Arthropod Diversity (CSUC), at Colorado State University, Fort Collins, Colorado. After more than 700 hours of identifying and sorting ~30,000 butterflies, all are arranged by species and identifiable subspecies, except for various tropical and Palearctic groups beyond Scott's expertise. Studying the specimens revealed some unnamed (identifiable) subspecies, and documented the geographic variation of many species. New research discoveries are reported here.

The CSUC butterfly specimens include the large collections of Richard W. Holland and Ray E. Stanford, and the smaller collections of Scott L. Ellis, Karolis Bagdonas, Charles P. Slater, R. Hammon, and others, numerous specimens collected by Paul A. Opler and Ken E. Davenport, as well as specimens collected by museum director Boris Kondratieff and many other museum associates and volunteers including Scott. A complete collection of foreign and American Anthocharini (Pieridae) was assembled by Opler. A few specimens each of many Palearctic species were assembled by Opler, Slater, and Stanford. There are many specimens from Mexico, and some from South America, several hundred from east Asia, and a few from Africa and Australia. The oldest specimens are some poorly-labeled specimens collected in ~1884 by David L. Bruce, and a few specimens collected by C. P. Gillette, the original founder of the museum. The final collection of several thousand specimens of Ernest J. Osler is present (mostly papered specimens without data). Most specimens are now being databased as part of a project in CSUC and 30 other museums (LepNet, <http://www.lep-net.org/>) to database Lepidoptera that have been identified to species/subspecies. The CSUC also includes fine collections of western North American terrestrial and aquatic insects including Colorado agricultural/horticultural/medical pest arthropods, the third largest and one of the best Plecoptera collections in North America, and a largely synoptic North American grasshopper collection curated by Timothy McNary. The types and most of the specimens discussed are deposited in CSUC.

Notable here is the cramped quarters housing the millions of museum specimens valued at \$6 million, which is packed into the lower floor of Laurel Hall. A new facility is needed, and community support is desirable to remedy this unfortunate situation.

March 17, 2015 2f. Canyon south of Butterbrecht Peak, Kern Co., California April 26, 2009 1m. Davenport collection has paratypes (most males with white dots) from: Sageland north of Kelthefore Valley, Kern Co. April 29, 1992, April 1, 2000, April 10, 1981, April 3, 1977. West of Sherman Pass 4900', Tulare Co. in side canyon May 14, 1987. Dry Creek Canyon, 4300', Tulare Co. March 21, 2002 ~10 most with white dots. South of Sageland, Kern Co., March 6, 2003. South of Sageland jct. of road SC123 April 11, 2011 2m. Piute Mts., east slope west of Sageland April 16, 2010 2m. Cherry Hill Road off Sherman Pass Road 5680', May 21, 2010. West of Sherman Pass at 4400' near Dry Creek Canyon, March 23, 2006.

Just east of the Sierra Nevada the dots are smaller or absent, therefore these populations are considered as close to *P. c. catullus*: At Lower Rock Creek Gorge, Mono County, California May 14, 2006 one has the dots and they are weak on another and absent on another; Whitney Portal Inyo County, California 1m weak dots; Pine Creek Camp, Inyo County, California 1m no dots, 1m weak dots, 1m stronger weak dots; 9 mi. south Big Pine, Inyo County, California 1m weak dots; 2. Pine Creek Canyon, Inyo County May 26, 2009 no dots; Silver City, Lyon County, Nevada 1f weak dots; Bishop Creek Lodge 8300', Inyo County California June 17, 2004 no dots.

The Central Valley of California has *P. c. catullus* because most specimens lack dots but a few have whitish dots: Yolo County, California 1m has weak dots; Porterville, Tulare County, California Sept. 12, 1995 1f with dots and several specimens without dots; 2 taken northwest of Pixley Tulare County August 22, 1987 lack dots; 4 [6.3] mi. south of Alpaugh Tulare County (actually correctly from Rowlee Road just south of Tulare County Rd, Kern County) August 11 & 23, 1984 and another taken on Hwy. 43 southeast of Alpaugh, Tulare County Aug. 11, 1984 seem intermediate to or close to nominate *P. c. catullus*; female north Sacramento, Yolo County, May 22, 1994 1f has dots.

Comstock (1927, pl. 58, Fig. 26) illustrated a male with white dots from Los Angeles, and wrote that western examples frequently have the dots, therefore those dots may be fairly frequent in the Los Angeles area and perhaps *P. c. crestar* is the subspecies there; more specimens should be examined from all over southern California. Emmel & Emmel (1973, pl. 10 Fig. 12) illustrated a female from Riverside County, California with tiny dots. We saw a male from San Diego, California with the dots.

Elsewhere, subspecies *P. c. catullus* adults usually have the hindwing solid black without dots, and we are confident that the starlike points are much less common there (at least traces of the dots occur in ~1/3 of the individuals at most, and evidently even fewer on the east coast of U.S., the presumed type locality of *catullus*), although specimens appear everywhere in the range that have white submarginal dots, which are generally small in females and tiny in males. We saw the dots on specimens from: Arizona 1m; Colorado 1m2f (very many lack dots); Indiana 1f; New Mexico 6m3f (very many lack dots); North Carolina 1m; New Jersey 1m; North Dakota 1f tiny dots; Oklahoma 1f; Oregon 1; Pennsylvania 1m; South Dakota 1f small dots; Texas 2 +1 tiny dots; Virginia 1; Washington 2. A check of photos in North American butterfly books etc. found 32 photos without the dots, and 16 with traces or larger dots, suggesting only a third of adults have at least traces of the dots, and few have large dots.

Literature Cited

- Comstock, J. A. 1927. Butterflies of California. Published by the author. 334 p. + 63 plates.
 Emmel, T. A., & J. F. Emmel. 1973. The butterflies of southern California. Natural History Museum of Los Angeles County, Science Series 26:148 p.



Fig. 1 (dorsal and ventral). *Pholisora catullus crestar* holotype male (CSUC).



Fig. 2. *Pholisora catullus crestar* types in CSUC, ups (holotype 2nd in 2nd row; others are paratypes).



Fig. 3. Paratypes of *Pholisora catullus crestar* in Scott collection, ups. All but one are males.

***Notamblyscirtes simius durango* Scott, new subspecies (Hesperiidae)**

by James A. Scott

Abstract. A new subspecies of *Notamblyscirtes simius* from Durango, Mexico, is described.

***Notamblyscirtes simius durango* Scott, new subspecies.** urn:lsid:zoobank.org:act:A6334ACE-6302-492E-AB88-44AC73653A20 **Definition.** This new subspecies differs from nominate *N. s. simius* (W. H. Edwards) by having smaller postmedian spots on the brown ventral hindwing (which is gray in *N. s. simius*), and the postmedian row of spots on dorsal forewing is bent more at a right-angle (*N. s. simius* has the band protruding distally much more in cell M₁ compared to cell R₅ that results in a protruding point to the band, and has a gray ventral hindwing with bigger spots). The six types seen (Figs. 4-7) are all dark-brown on upperside, whereas in southern Colorado and northern Arizona-New Mexico *N. s. simius* approximately half of adults are some shade of orangish-brown and some are fully brownish-orange (infrasubspecific form *rufa*).

Material examined: Male holotype and 4 male 1 female paratypes from the type locality Mexico, Durango, 3 mi. east Mimbres, Hwy. 45, July 27, 1981, Ray E. Stanford (all in CSUC).



Figs. 4 (dorsal)-5 (ventral). *Notamblyscirtes simius durango* holotype, in CSUC.



Figs 6 (dorsal)-7 (ventral). *Notamblyscirtes simius durango* types: 5m (holotype upper left) 1f (lower right), all from type locality.

Distribution. *N. s. durango* also occurs in southern Arizona based on the few adults examined, which are also similarly brown on underside, with similar markings. *N. s. durango* is uncommon in southern Arizona, and in Arizona as well as in Mexico it flies a month later than *N. s. simius*, evidently to better synchronize the adult flight and the first-stage larvae with summer monsoon rains, which would seem to be important because in *N. simius* the tiny unfed 1st-stage larvae diapause in the hostplant bases/soil litter for a lengthy period through summer fall and winter until the next spring (Scott 1992).

Note that the type locality and lectotype of the name *simius* were corrected by Scott (2008): The type locality is Pueblo, Pueblo County, Colorado. The original description listed the type locality as “Oak Creek Can. Colorado.....Pueblo, Colorado”, which was “restricted” to Oak Creek Canyon, Custer County, Colorado by Brown & Miller (1987), who invalidly designated a lectotype. There is no Oak Creek Canyon in Custer County but an Oak Creek Canyon in Fremont County is near Pueblo, however this canyon itself lacks the shortgrass prairie habitat typical of *N. simius*, whereas both habitat and butterfly are plentiful near Pueblo. Therefore, the correct type locality is Pueblo. Holland (1931, not 1898) p. 369 designated the valid lectotype (the same specimen that Brown and Miller {1987} subsequently chose to designate as invalid lectotype).

Literature Cited

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Euchloe hyantis guaymasensis Opler, new combination (Pieridae)

by James A. Scott

Abstract. Many intergrading specimens from Sonora, Mexico, seem to show that *E. h. guaymasensis* is a subspecies of *E. hyantis*.

This distinctive butterfly was named as a species by Opler (1987) as *E. guaymasensis* from Sonora, Mexico, because the wings are usually light yellow, often white, the ventral hindwing is less mottled with each greenish stripe quite narrow, and the forewing tip is congested black. Since then Paul A. Opler found an area in Sonora just south of Arizona where *guaymasensis* appears to intergrade with *E. hyantis* (W. H. Edwards). Specifically (Figs. 8-10), among 41 males collected, one is just as yellow as most *guaymasensis* and three are yellowish-white, and eight have weak green mottling like *guaymasensis* and others have intermediate mottling, while some have the forewing tip slightly more congested than *hyantis* but only a few have the forewing as darkly-congested as most *guaymasensis*. The intermediates have the same mate-locating system as Arizona *E. hyantis*, specifically fleeking (flying to seek females) around the habitat especially on hilltops/ridgetops, as males often patrol about the top to wait for females to come there to mate.



Fig. 8. *Euchloe hyantis* X *guaymasensis* 3 mi. west Cuitaca, Sonora, July 19, 2004. Fig. 9. *E. hyantis* X *guaymasensis* 1 km west and southwest Cuitaca, March 20, 1998 and 2003. Fig. 10. *E. hyantis* *guaymasensis* from various sites farther south in Sonora, Mexico. The degree of ventral hindwing mottling can be seen through the wings of dorsally-mounted specimens.

Back et al. (2011) reported that hybridized populations also occur at Bisbee in the Mule Mountains of Cochise County, Arizona, with individuals with lesser green mottling on ventral hindwing, and similar adults occur even in the Santa Rita Mountains of Santa Cruz County, Arizona. Those authors reported that the black discal cell bar on the forewing becomes smaller in *E. hyantis* populations as one travels from southern Utah *E. hyantis* (which they called *E. h. lotta* Beutenmueller) to southern Arizona *E. hyantis* ssp. near the range of *guaymasensis*.

This seems to be obvious intergradation, even though *lotta* phenotypes predominate in Figs. 8-9 evidently because the locality was at the southern margin of the range of *lotta* which was more common in the region than *guaymasensis*. If there is genetic incompatibility between *guaymasensis* and *lotta*, it is not apparent to me on the photos. So far *guaymasensis* does not seem to be disappearing, and its genes have been found northward in Arizona. The specimens seem to show many more intermediates than known cases of distinct species that hybridize and just produce rare hybrids. Therefore there seems to be little reproductive isolation, hence *guaymasensis* is considered to be a subspecies of *E. hyantis*, **new combination**.

Several unproven speculations can be mentioned. One could guess that *guaymasensis* is contacting *E. h. lotta* more today than in the past, because *guaymasensis* is spreading north due to global warming. Or one could suppose that weeds are allowing the two to come together. At the Cuitaca locality larvae eat *Descurainia pinnata* (a larva was found by Jim Brock, according to P. Opler, personal communication), a Brassicaceae weed, whereas farther south P. Opler noted *guaymasensis* is usually associated with a white-flowered native mustard. But ssp. *lotta* is doubtfully spreading southward because of newly-introduced Brassicaceae weeds, because there are very many of those Brassicaceae weeds and they were introduced long ago mostly ~150 years ago to western North America so their distribution surely includes much of Mexico and has doubtfully increased just in the last few decades; for instance five abundant Brassicaceae weeds including *D. pinnata* are mapped all over most of U.S. including the border with Sonora in the 1970 book Common Weeds of the United States (USDA, Dover Publications, New York, 463 p.), showing that those weeds had fully spread everywhere by that time.

Future samples may determine whether the *guaymasensis/hyantis* phenotypes are changing in frequency in that area.

Back et al. (2011), using the small mitochondrial COI sequence, reported that *guaymasensis* mtDNA is most similar to *Euchloe olympia* (W. H. Edwards), which is very different in appearance (*E. olympia* lacks the forking greenish mottling on ventral hindwing tornus for instance) and flies with *E. hyantis* in Montana without interbreeding. But Back et al. (2011) also reported that a short length of nuclear DNA proves that *olympia* is actually more similar to *E. ausonides* (Lucas) whose mtDNA greatly differs. They also reported that the nuclear histone3 gene sequence is identical in *hyantis* and *guaymasensis*, which “points to the actual hybrid identity of these two species.” And they reported that intergrades between *guaymasensis* and *lotta* (from Bisbee in the Mule Mountains of Cochise County, Arizona, and from Sonora Mexico) had two different kinds of mtDNA that were similar to the most different types of *E. hyantis* mtDNA. Obviously when two populations hybridize, the offspring will inherit the mtDNA of the interbreeding mothers because mtDNA is inherited in the cytoplasm of the egg, and at the northern edge of the geographic range of *guaymasensis* near the huge range of *E. hyantis*, the *hyantis* mothers evidently produced more offspring, and the presence of two very different types of mtDNA within the *guaymasensis* X *hyantis* intergrade populations means that the ancestral *hyantis* mothers mated with *guaymasensis* males multiple times (at least twice); it was no rare occurrence.

The reported mtDNA (Back et al. 2011) seems to have misplaced the phylogenetic position of *guaymasensis*, because *E. olympia* and *Euchloe creusa* (Doubleday) were confidently placed into the *E. ausonides* group by Opler (1966-1983) using characters of male genitalia (valva and juxta), larval color patterns, chaetotaxy, oviposition site preference, pupal shape, and adult wing venation, etc.

Notable here is the occasional appearance of slightly-yellowish-white individuals throughout most of the range of *E. hyantis* including *lotta*. Ray E. Stanford caught two in one day at Little Rock in Los Angeles County, California, March 22, 1960. Nearly all *E. hyantis andrewsi* Martin are slightly yellow.

Species should be defined by the ability of taxa to interbreed; they should not be defined by a tiny stretch of DNA that has proved to be partly or completely useless for the study of phylogeny. The COI sequence of mtDNA often helps determine phylogeny of butterflies that have been evolving for some time, but seems to be not very useful for the determination of phylogeny in recently-evolved butterfly

northeastern Arizona specimens examined, most in CSUC. At Mexican Water, Apache County in extreme northeastern Arizona, only one of four has a quadrate spot. In Moffat County in northwestern Colorado north to Carbon County in southern Montana, the spot is always just a narrow dash.

Therefore, west-central Colorado-east-central Utah would seem to have a distinctive subspecies. However, the lectotype of *lotta* designated by Opler (2008) from Kanab, Kane County, Utah also has a square-shaped spot and greener mottling (Fig. 11). And the few specimens seen from Utah also have the quadrate spot (a female from 38 mi E. Kanab in Kane County, Utah, one from Big Canyon, Utah County, Utah (both illustrated at <http://butterfliesofamerica.com/>), one from SSE Levan, Juab County, Utah, one from Burn Peak Road, Juab County, Utah, one from Antelope Island in Davis County, Utah with a large near-quadrate spot, and one from Sandy Valley, Clark County, Nevada). These specimens have quadrate spots, and mostly rather extensive green mottling. Central Nevada adults are also similar, as 45 specimens from Austin Summit in Lander County, Nevada collected by Scott have a moderately developed to quadrate spot (rather quadrate in nearly 50%), and 31 specimens from west of Fallon in Churchill County, Nevada coll. Scott are similar as they have a narrow to quadrate spot, relatively large in most; the greenish mottling is relatively heavy in central Nevada but seldom as extensive as most west-central Colorado specimens. Adults in Harney County in southeastern Oregon often have a quadrate spot also. We have not seen enough specimens from the Kanab Utah area (the locality of the lectotype) to prove that they are always this quadrate-heavily-green-mottled subspecies, and Utah collectors offer no help, but it appears certain that most from southern Utah have a large quadrate spot conforming to the concept of *E. h. lotta*.

The range of *E. h. lotta* evidently extends from west-central Colorado down the Colorado River into southern Utah and western Utah (and probably the Grand Canyon in Arizona) and intergrades westward as rather similar adults are frequent in Nevada and southeastern Oregon.

The rest of the range formerly considered to have *E. h. lotta* seems to have one or several unnamed subspecies more similar to *E. h. hyantis* or (in the southern areas) has populations intermediate to the redefined *E. h. lotta*. Therefore, we need to determine whatever geographic variation occurs in this area.

Opler (1966-1983) studied and revised the American *Euchloe*, and found that the California populations in the North Coast Range and the Sierra Nevada have a narrow black bar; he called them *E. hyantis hyantis*, therefore they should continue to have that name. Opler (1974, p. 4-5) tabulated that *E. h. hyantis* usually feeds on *Streptanthus* at least at the frequent serpentine localities, although *Arabis glabra* is sometimes used, while his *E. h. lotta* hostplants are numerous Brassicaceae including *Caulanthus*, *Descurainia*, *Isatis*, *Sisymbrium*, *Stanleya*, and *Streptanthella*. Opler (1968, p. 71) mapped various segregates of California *E. hyantis*, including subspecies *hyantis* in the northern Coast Range and around Mt. Shasta, and a segregate of subspecies *hyantis* (also feeding on *Streptanthus*) occurring at middle and high altitudes in the Sierra Nevada west of the Great Basin. He mapped *E. hyantis lotta* in all the California deserts and Great Basin, plus segregates on the Mt. Pinos block, and the Peninsular Ranges mostly from San Diego County in southern California; those segregates have not been named as subspecies by later authors because they are not visibly strongly different.

The San Diego County segregate has slightly different mtDNA (Back et al. (2011), therefore could possibly be named a new subspecies. The Mojave Desert-Arizona-New Mexico butterflies might be named as a new ssp., though they vary and some have the quadrate spot therefore many populations can be considered to be intergrades with *E. h. lotta*, while the northeastern Arizona and southwestern Colorado adults have a narrow spot. And the northwestern Colorado (Moffat County) to Montana (Carbon County) populations (not seen by Opler 1966-1983 and not plotted on his map, Opler 1968 p.71) and Washington-British Columbia adults have a narrow spot, much different from west-central Colorado adults, and therefore definitely seem to be a separate subspecies from *E. h. lotta*.

The name *belioides* Verity, 1911 seems to fit the need for a name for at least some of the non-quadrate-spot populations of what was formerly considered to be *E. h. lotta*. Pelham (2008) lists the

original name and publication as “*Euchloe belia* var. *belioides* (Rhop. Palae.: 339 [31 Oct 1911]; pl. 37, figs. 17 female dorsal, 18 female ventral [30 Apr. 1909]; ind. syst.: xxxi [31 Oct 1911]” and lists it as an available subspecific name with the type locality “Arizona” and “St. Ignatius, Montana” implied from the legend to plate 37. [St. Ignatius, Lake Co., Montana] “Location of syntypes not known.”

We investigated the name *belioides*. The French to English translation from the original description (pages 181-182 of Verity, 1911) follows:

var. **creusa**. (Pl. XXXVII, fig. 16-19)

creusa, Doubl. & Hew., Genera Diurn. Lep., pl. VII, f. 1 (1847); Holland, Butt. Book, p. 283, pl. XXXII, f. 23; pl. XXXIV, f. 2 (1899).

The forms of *belia* which fly throughout the United States are very varied, but unfortunately their distribution is little known, especially because of the confusion that the American authors have made in the determination of their specimens.

In the Nearctic region, the forms of *belia* can be grouped into two groups which correspond fairly well to those of the Palearctic region and which repeat in the spring form as in the summer: one with anterior wings acuminate, triangular, a pattern of an intense black, has a fairly broad discoidal bar; the other has rounded wings, has pattern of a light gray, has thin discoidal bar.

The pattern on the reverse, though very variable, present, however, a disposition which is constantly distinct from that of the *belia* of Europe; In some it recalls that of *simplonia*, in others it approaches *orientalis*, but generally it presents wider white spaces than is ever the case in the Palearctic region in the first generation.

Holland [l. c.][Scott & Opler note: an aberration Holland 1899 The Butterfly Book describes on p. 283] describes a female whose discoidal bar is so great that it invades the outer half of the cell.

The form which received the name of *hyantis*, Edw. [Trans. Am. Ent. Soc., III, p. 205 (1871)] and which would fly on the coast, is distinguished from the true *creusa* by its superior size, by its designs of a more intense black; the bar of the cell is thinner, sharp/acute/pointed towards the costa, it is not curved and it is never traversed by a white streak; on the reverse, the pattern is more plain, the spaces white are less wide and has less distinct outlines, between yellows.

This description includes several known taxa and is of little help.

The word *belioides* appears in the entire Verity (1911) book only on the “Errata-Corrige”[Errata-Corrigenda in English] page in the front of the book, and does not appear on the plate legend “Planche XXXVII” or on the text pages 181-182. That Errata-Corrigenda writes that on the legend of plate XXVII figs. 17-18, instead of [“An lieu de”] the words “*creusa*, Doub. & Hewitson”, must be corrected and listed as [“Lisez:”] the words “*belioides*, Verity”. Simply stated, Verity used that Errata-Corrige table to correct the name *creusa* to *belioides* on that plate legend. The name *creusa* is treated as *Euchloe belia* variety *creusa* in the text referring to figs. 17-18, so Verity corrected the text for figs. 17-18 on pages 181-182 to refer to *Euchloe belia* variety *belioides*. Therefore, because Verity treated *belioides* as a variety of *E. belia*, we treat *belioides* as a subspecific available status name, because simply-stated (not stated to be infrasubspecific) “varieties and forms” prior to 1961 are considered to be subspecific available names in the ICZN Code.

Both specimens on Verity’s figs. 17 and 18 are syntypes of Verity’s subspecific name *belioides*, but they belong to two currently-understood subspecies. Verity’s Fig. 17 of *belioides* is stated on the plate XXXVII legend to be “*E. belia*, Cr. var. [*belioides* substituted for *creusa* because of the errata] female (Arizona) [coll. Obth. {Oberthuer}] 181.”, and has a large quadrate cell spot, so the specimen is evidently typical *E. hyantis lotta* if it was from northern Arizona, or a *lotta*-intergrade population from elsewhere in Arizona. Verity’s Fig. 18 of *belioides* is stated on the plate XXXVII legend to be “*E. belia*, Cr. var. [*belioides* substituted for *creusa* because of the errata] female reverse (S. Ignatius, Montana) [coll. de Joannis]”. This Fig. 18 has a narrow black discal cell bar (our Fig. 16), so the female is a member of the northern *E. hyantis* ssp. with narrow bar.

To make the name *belioides* maximally useful for naming geographic segregates of *E. hyantis*, we hereby deliberately and intentionally designate the female specimen with small black bar from S. Ignatius, Montana, illustrated on Verity’s plate XXXVII Fig. 18 and on our Fig. 16, to be the **lectotype** of *E. belia*

var. *belioides* Verity, 1911, now known as *E. hyantis belioides*. The specimen was from the “Joannis” collection; we have not determined the current location of the specimen.

This designation of the lectotype means that the name *belioides* (type locality St. Ignatius, Lake County, Montana) can be used as the subspecies with a smaller black cell spot at least in most of northwestern Montana, Washington, and Oregon, and for the time being also for the northwest Colorado to south-central Montana population (which may? be designated as a separate subspecies in the future) and provisionally even in most other southeastern California-Nevada-Arizona-New Mexico-SW Colorado regions that have a primarily-narrow black bar. A detailed study of a large number of specimens etc. may produce a better analysis of the subspecies and intergrade zones of this butterfly in that southern area.

There seems to be little justification for recognizing *lotta* as a separate species from *E. hyantis*, although hostplants evidently differ and wing pattern is slightly different, but *E. h. hyantis* and *E. h. lotta* seem to intergrade or at least have not been shown to be sympatric without interbreeding. The wing pattern traits vary and seem to intergrade completely. Back et al. (2011) found that mtDNA is similar in all *E. hyantis/lotta* populations which formed a rather compact cluster on their *Euchloe* phenogram as no population was much different and many geographically-distant specimens had similar mtDNA, and they considered *lotta* to be conspecific with *hyantis* as they could not be distinguished using mtDNA. Further studies using whole-genome DNA may greatly improve our knowledge of the geographic segregates of *E. hyantis*.

And the numerous specimens collected by Ken Davenport in the southern end of the Sierra Nevada in CSUC cannot be readily separated into *E. h. hyantis* or the Mojave Desert subspecies formerly called *E. lotta* using wing pattern and also seem to be intermediates (some can be identified as *hyantis*, some have a moderate or larger spot and can be identified as the desert subspecies, but most are questionable). There are several phenotypes of *E. hyantis* in southwestern Oregon (Warren 2005 notes that the Rogue River population illustrated at butterfliesofamerica.com has thicker greenish unmottling), and several varieties of these butterflies occur in the San Bernardino Mountains of southern California. The pattern of geographic variation in these butterflies is obviously rather complex, and regions with variable populations should not be given simple names.

Euchloe hyantis lotta: Following is a list of specimens of the nearly-always-quadrate-spotted *lotta* from west-central Colorado and adjacent Utah, including those shown on Figs. 12-15 (all in CSUC except those in Scott collection=JAS): **Mesa Co., Colorado:** 1m Black Ridge, 5 mi. north Glade Park, 20v-67 R. E. Stanford (RES); same data 1m2f; Coal Mine Point, 7180', Black Ridge 27iv81 RES 1m; same 7100' 4v74 RES 2f; same 23v68 1m; same 7v77 1m1f; Black Ridge 7000' v-16-65 Scott L. Ellis (SLE) 2m; Black Ridge, Coal Mine Pt. v-11-63 probably SLE 1f; Black Ridge May 22, 1965 probably SLE 1m; Black Ridge 23 May 68 RES 1m; Beacon Ridge, 7145', 3-v-80 no coll. 2m; John Brown Can., 5600', 0.8 mi. west Gateway, 1-v-83 RES 2m; same 4900', 3-iv-98 John S. Nordin 1f; same canyon 22-iv-72 SLE 1m3f; near Grand Junction Airport, 4880', 4-v-74 Michael S. Fisher=MF 1m; gulch near De Beque, 29-iv-78 J. Scott JAS 1m; Unaweep Can., 5-6000', 5-10 mi. east of Gateway, 3-v-74 RES 1f. **Delta Co., Colorado:** Lawhead Gulch, Redlands Mesa, 6000'; iv-9-66 SLE 10m1f; Diamond Joe Gulch, Black Ridge, T1N R8W S11, 6480', 29-iv-1972 SLE 2m; Smith Fork Can., 5500', 23-iv-65 SLE 4m; same data S. L. Ellis in JAS coll. 2m; Scenic Mesa, 5090', Smith Fork Canyon rim, Apr. 24, 1972 SLE 1m; Smith Mtn. top 6500', May 6, 2014 J. Scott JAS 2m; Leroux Creek X road 3100, 6500', May 5, 2014 J. Scott 4m; Escalante Can., 5-5300', 12 mi. west Delta, 4-v-74 RES 1f; Stingley Gulch, Redlands Mesa, iv-7-63 SLE 1m; same 4-v-63 SLE 1m4f; same 6260' T14S R93W S9 1-v-72 SLE 1f; same 6300', iv-20-62 SLE 1m; Paonia, 6400', 28-iv-72 SLE 1m; Hotchkiss, S. L. Ellis family ranch/orchard, Apr. 16, 1961 1m, S. L. Ellis in JAS coll.; southwest of Hotchkiss, 25-v-68 RES 1m; 1015 (SLE field number, but number missing in his notebook) 2m; 7506 (SLE field number, but year 1975 records are all missing from his notebook) 1f. **Montrose Co., Colorado:** Paradox Can., 5700', Dolores River, 3-v-74 RES 3m2f; Transfer Road, 11.3 mi. west public land boundary, v-9-72 SLE 1m; Sewemup Gulch nr. Dolores River,

Mesa/Montrose Co., Colorado 3-v-74 RES 1f; 4 air mi. west Uravan, 29-vi-78 J. Scott JAS 2m; Cahone Crk., 0.5 mi. south Cahone, 6600'. **Dolores Co., Colorado:** 1-v-74 MF 1m; Coal Bed Can., 6200', 10 mi. west Dove Creek, iv 1974 RES 2m. **Garfield Co., Colorado:** 2 mi. northwest Carbondale, v-1-66 SLE 1f; 6 mi. north Parachute, 27-iv-81 RES 2m. **San Miguel Co., Colorado:** Chico Creek, 7000', 1.9 mi. south Egnar, 1v82 RES 1f. **Grand Co., Utah:** north end Thompson Can., 39°03.61N, 109°43.76W, oak-rabbitbrush sage 6000' 6 p.m. Chuck Harp 1f.



Fig. 11. *Euchloe hyantis lotta* lectotype, Kanab, Utah. Fig. 12. *E. h. lotta* male, Black Ridge, Mesa County, Colorado.



Figs. 13-15. *Euchloe hyantis lotta* from west-central Colorado and adjacent Utah in CSUC collection. Note the quadrate spot, and the usually-extensive green mottling.

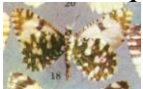


Fig. 16. *Euchloe hyantis belioides* lectotype female from St. Ignatius, Lake County, Montana, illustrated by Roger Verity (1911) pl. XXXVII Fig. 18.

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(Nymphalidae)

Limnitis weidemeyerii Subspecies in New Mexico and Vicinity (Nymphalidae)

by James A. Scott

Abstract. The distribution of the subspecies of *Limenitis weidemeyerii* in southwestern United States is detailed.

Richard W. Holland's specimens and others in CSUC document the distribution of the subspecies of *L. weidemeyerii* W. H. Edwards in New Mexico and Colorado, and this note details the subspecies that occur in each mountain range. Some subspecies misassignments in Holland (2009) are corrected.

Subspecies *angustifascia* (Barnes & McDunnough) has a narrower white median dorsal band, and occurs with little variation all over southern New Mexico including the Gila-Gallo-Mangas, Sacramento, and Capitan Mountains, the Black Range, the Magdalena, San Mateo, Zuni, and Chuska Mountains, westward through Arizona. It also occurs in northern Mexico. In the Spring Range of southern Nevada *nevadae* (Barnes & Benjamin) is basically a synonym as the white bands are equally narrow, though on dorsal hindwing the veins are slightly darker as they extend across the narrow white band.

Subspecies *weidemeyerii* has a wider white band and occurs in northern New Mexico in the Manzano, Sandia, and Jemez Mountains, and throughout Rio Arriba County and the San Juan and Sangre de Cristo Mountains and Raton Mesa.

In Colorado, subspecies *weidemeyerii* occurs east of the continental divide, while on the western slope the white band is a little wider, therefore those butterflies can be called *weidemeyerii* X *latifascia* S. Perkins & E. Perkins; *latifascia* is the wide-banded subspecies that occurs in Utah and most of Nevada, west to Mono County, California.

Northward in Wyoming, Nebraska, and the Dakotas the specimens and photos examined do not seem to differ in average white band width from those on the eastern slope of Colorado, therefore *oberfoelli* Brown is a synonym of *weidemeyerii*. Those bands do vary in width, especially within the ranges of subspecies *weidemeyerii* and *latifascia*.

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Asterocampa celtis subspecies in New Mexico and vicinity (Nymphalidae)

by James A. Scott

Abstract. The distribution of the subspecies of *Asterocampa celtis* in southwestern U.S. and Mexico is detailed.

Richard W. Holland collected a large number of *Asterocampa celtis* (Boisduval & LeConte) throughout New Mexico and vicinity (now in CSUC), and I collected many specimens in Colorado, documenting well the distributions of the subspecies there, and adding to the distributional information in the *Asterocampa* revision of Friedlander (1987).

Asterocampa celtis montis (W. H. Edwards) (orangish-brown upperside coloration, the submarginal dorsal fw eyespot in cell M₃ a black ring and eyespot in cell CuA₁ a solid black spot) occurs in the San Mateo Mountains and Magdalena Mountains and Ladron Peak all in Socorro County, and the Organ Mountains of Doña Ana County, New Mexico, westward into southeastern Arizona. In the Sacramento Mountains and in southwestern New Mexico in Luna County *A. c. montis* occurs with the lower eyespot usually having a pinpoint of white. Holland (2009) lists it from Raton Mesa complex and Clayton Lake in northeastern New Mexico but those are surely *A. c. antonia* (W. H. Edwards) (otherwise his results agree with mine). Subspecies *antonia* (grayer-brown upperside, upper ocellus a thick black ring but lower ocellus a black patch with small white center) occurs in Guadalupe Mountains and north of

RWH 17378. 5m1f Cedar Creek, Ruidoso, Sacramento Mts., Lincoln Co., New Mexico 7500' 4-vii-76 RWH 8495 (1m in Scott collection). 2f 2 mi. west NH37, Cedar Crk., Sacramento Mts. Lincoln Co., New Mexico 7000' 4-vii-81 RWH 12697. 1f Eagle Crk., 3.5 mi. east of Alto, New Mexico 532 at NA21, east slope Sacramento Mts., Lincoln Co., New Mexico 7800' 1-vii-2000 RWH & SJC, RWH 19941.

The biology of *P. c. apache* is unknown, but the larvae must eat some *Aster* species growing on north-facing slopes and along mostly-semi-shaded gulches/creek banks, as does *P. cocyta* in Colorado where the hostplants are *Aster laevis* and *Aster foliaceus*.



Figs. 17-20. Holotype *Phyciodes cocyta apache* male, dorsal and ventral and label, in CSUC.



Figs. 21-22. All types of *Phyciodes cocyta apache*, ups (holotype is left photo third row right end), in CSUC.

Other endemics in the Sacramento Mountains Range. This range (and the adjoining Capitan Mountains) in southern New Mexico has four distinctive subspecies of butterflies, which moved there from the Colorado Rocky Mountains in Pleistocene ice advances, and then were isolated there in warm periods and developed a different appearance. *Phyciodes cocyta apache* is one of them. The other distinctive subspecies are these: *Callophrys sheridanii sacramento* Scott (Lycaenidae) has a narrower white band and a greater area of brown on ventral forewing and larger size (Scott 2006, in Scott et al. 2006). *Speyeria hesperis capitanensis* Holland (Nymphalidae) is melanic on the blacker dorsal wing bases therefore is rather distinctive (Holland 1988); it is darkest in the Capitan Mountains, an eastward extension of the Sacramento Mountains, and slightly less dark in the main Sacramento Range in Lincoln and Otero counties. *Euphydryas anicia cloudcrofti* Ferris & Holland (Nymphalidae) (Ferris & Holland, 1980) is identical to the Colorado *E. anicia capella* W. Barnes on the upperside, except the white area distal to the ventral hindwing median cream band is usually wider. However *cloudcrofti* appears to not be an endemic, because the CSUC has identical *E. a. cloudcrofti* specimens from the Zuni Mountains of Valencia County, New Mexico (Pole Can. 8000'), and the Sangre de Cristo Mountains in San Miguel County, New Mexico (El Porvenir 7700') and Mora County, New Mexico (Coyote Crk. 7500') which were paratypes in the original description of *E. a. cloudcrofti* (Ferris & Holland 1980); they are evidently scarce in those three counties as few specimens exist. *E. anicia* is also scarce northward in the Wet Mountains foothills of southern Colorado, where Scott & Scott (1978) found no *E. anicia* specimens, even though there are records of *E. anicia* in the Wet Mountains foothills that are 51 and 74 years old of what might be the similar *E. a. capella*.

Authors have often been too eager to name butterflies from the Sacramento Mountains. *Callophrys dumetorum* ("affinis") *albipalpus* Gorelick (Lycaenidae) was named as a distinct subspecies (Gorelick 2005) from the northern Sacramento Mountains {Gorelick noted that several specimens poorly labeled just Otero County in the first decade of the 1900s resemble *C. d. apama* (W. H. Edwards), and we note that those were likely mislabeled as were the *Argynnis nokomis* (W. H. Edwards) mislabeled from there (Scott & Fisher 2014)}. However, the traits by which *C. d. albipalpus* was distinguished are weak, as Gorelick wrote that the minuscule distal segment of the labial palp is whiter versus blacker in other subspecies and the unh spots lack black inner edging, but all the green *Callophrys* (*Callophrys*) have the palpi mostly whitish, and the unh spots on the types do have blackish inner edging (including on Gorelick's figures). Thus *C. d. albipalpus* appears to be best treated as close to *C. d. homoperplexa* (W. Barnes & Benjamin), intergrading with subspecies *apama* (Edwards), in which the second generation has more unh spots than the first, thus the name is invalid because it is just an intergrade between named subspecies.

Poanes hobomok (T. Harris) from the Sacramento Mountains was called an endemic "near *wetona*" by Holland (2010a); but series from there and from Raton Mesa on the New Mexico-Colorado border and from the Wet Mountains of Colorado show that Raton Mesa has a population close to *wetona* Scott, and the Sacramento Mountains has *P. hobomok* closer to *P. h. hobomok* because they are somewhat darker than topotype Wet Mountains Colorado *wetona* and females are darker, more similar to subspecies *hobomok* (*P. h. wetona* from the Wet Mountains has females that resemble males and are little darker).

Several other butterflies named from the Sacramento Mountains seem to be synonyms: *Phyciodes pulchella sacramento* Scott (Nymphalidae) appeared to be a little more orange on dorsal hindwing in Scott's original series (Scott 2006, in Scott et al. 2006), but specimens collected since including larger numbers collected by Holland and Steven J. Cary now in the CSUC show very little difference from normal *P. p. camillus* (Edwards). *P. pulchella sacramento* is herein considered as a **new synonym** of *P. pulchella camillus*.

Argynnis nokomis tularosa Holland was named from four specimens supposedly collected in the Sacramento Mountains (Holland 2010b), but those specimens proved to be subspecies *nokomis* W. H. Edwards collected from Beulah in San Miguel County in northern New Mexico that were mislabeled (Scott & Fisher 2014). Two Polyommata (Lycaenidae) subspecies were described from the Sacramento Mountains (Holland 2011), but *Glaucopsyche lygdamus ruidosa* Holland appears to be a synonym of *G. lygdamus oro* (Scudder), and *Plebejus icarioides sacre* Holland appears to be a synonym of *P. icarioides lycea* (W. H. Edwards). *Satyrium titus carrizozo* Holland (Lycaenidae) from the northern Sacramento Mountains (Holland 2010a) appears to be a synonym of *S. titus immaculosus* (W. Comstock) or is similar to it, because the black unh dots are as small as western U.S. *S. t. immaculosus* or sometimes nearly as small, and the orange spots are as small as those on *immaculosus* and sometimes smaller; *carrizozo* was unfortunately based on only six males and two females and one of those Holland wrote is an aberration, and the range of other *immaculosus* is distant, therefore there is some uncertainty regarding its status. Studies of geographic variation in *S. titus* have been compromised by minuscule sample size (Gatrelle 2004). The valid subspecies of *S. titus* appear to be these: *S. t. immaculosus* occurs on the western slope of Colorado to Washington, while specimens east of the continental divide in Colorado (including specimens on the Raton Mesas in Colorado-New Mexico which are not *immaculosus* as Holland wrote) with somewhat larger spot size are *S. titus immaculosus* X *watsoni* (Barnes & Benjamin), and the spot size becomes larger only eastward in the woodland areas of North America where *winteri* (Gatrelle) and *campus* (Gatrelle) appear to be synonyms of *watsoni* which occurs over most of eastern North America, and finally *S. titus titus*=*mopsus* (Hubner) in southeastern U.S. has larger black unh spots ringed with white plus larger redder spots. The isolated *S. t. occidentalis* Austin & J. Emmel from northeastern Nevada may be a valid ssp.

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***Phyciodes tharos*, *P. cocyta*, and *P. batesii* Range Extensions in Montana, Wyoming, Colorado, Utah, and Arizona (Nymphalidae)**

Abstract. New distribution records of *Phyciodes tharos riocolorado*, *Phyciodes cocyta selenis* and several *P. batesii* subspecies (*lakota*, *anasazi*, and *apsaalooke*) from western U.S. are provided.

Phyciodes tharos riorcolorado Scott has been found farther north, in Eagle County Colorado (2 mi. west Dotsero, April 27, 1996, P. A. Opler 2m), and in Mesa County (Watson Island, Grand Junction, May 16, 1994, S.M.N.). These have black nudum on the antenna club, unlike the orange nudum of *P. tharos orantain* Scott and *P. cocyta selenis*, and adults are small, quite orange, and bivoltine. They occur on the lower Gunnison and Colorado River bottoms in Colorado and Utah.

Phyciodes batesii lakota Scott occurs in southeastern Montana in Powder River County (Fort Hawes Ranger Station, May 25, 1979 Tim J. McNary 1m (with *P. tharos orantain* Scott 4m). *P. batesii lakota* Scott occurs in southeastern Montana and the Black Hills of northeastern Wyoming and the Pine Ridge of northwestern Nebraska, northward, then eastward to Michigan and Ontario.

eastern and southeastern Utah where there is plenty of sliding dirt near gulch bottoms, the habitat of the hostplant *Aster glaucodes*.

P. batesii anasazi occurs in southwestern Colorado in Mesa Verde National Park, Montezuma County (June 30, 1929 and July 25, 1930, Paul R. Franke 2f; North Rim Overlook, June 28, 1999, B. Kondratieff, D. Leatherman, M. Weissmann, 1m). *P. b. anasazi* occurs in western Colorado in Delta County (Leroux Creek 6500', June 20, 1962, Scott Ellis 1m) and Pitkin County (Crystal River, 6600', Hwy. 133, July 20, 2014, J. Scott, 3m1f and larvae on *Aster glaucodes*; and Crystal River north of Redstone 7100', June 21, 1992, John S. Nordin 5m2f {sympatric with 2m1f *P. cocyta selenis*}) and Gunnison County (east of Oliver Mine, just west Hawksnest Mine, July 19, 2014, J. Scott, 2f and larvae on *Aster glaucodes*), and Ouray County (1/4 mi. up Tomboy Road, near Telluride, July 18-19, 2008, Mike S. Fisher 1m1f near *Aster glaucodes*). It has not been found yet in the Yampa River drainage of northwestern Colorado, but surely occurs in Dinosaur National Monument in Moffat County.

P. batesii anasazi occurs in Arizona (and presumably also in New Mexico) in the Chuska Mountains (4 miles above Cove, on road to Lukachukai, 7000', Apache County, Arizona, R. W. Holland, June 28, 1978 22m6f, July 23 1978 4m; ridge 3 mi. northwest Cove, 7300', Apache County, June 30, 1974 R. W. Holland 2m2f; Chuska Mts. 7000' June 15, 1971 R. W. Holland 1m1f; Chuska Mts. 7300', June 30, 1974 R. W. Holland 1f). It probably occurs also along the San Juan and Animas River canyons in San Juan and Rio Arriba Counties in northwestern New Mexico.

P. batesii anasazi occurs in northern Arizona below the North Rim of the Kaibab Plateau in Grand Canyon National Park (numerous records including North Rim July 18, 1934 Frank E. Lutz 1m, and June 25, 1966, J. H. Hessel 1m, and upper section North Kaibab Trail May 30, 1987 1m, and Roaring Springs Trail May 25, 1991 P. A. Opler 5m), and in Oak Creek Canyon south of Flagstaff in Coconino County (June 1949, Jerry A. Powell 1m2f). These Arizona specimens including those from Oak Creek Canyon are normal *anasazi* with more orange overall coloration than other *P. batesii* (Reakirt) subspecies.

Phyciodes batesii apsaalooke Scott. A male that closely resembles this subspecies is in the CSUC from the Wyoming Range of southwestern Wyoming (Figs. 23-24). (There is just one specimen available and many are needed to be confident of the identity of many *Phyciodes* taxa, but it looks like it is probably not an individual variant of the more orange *P. b. anasazi* Scott, and is doubtfully a specimen of *P. cocyta*.) The hostplant *Aster glaucodes*=*Herrickia glauca* occurs there and in the foothills of the western half of Wyoming and Carbon County, Montana and the extreme southeastern corner of Idaho (plus the central and eastern mountains of Utah and northern Arizona and northwestern New Mexico)(Nesom, 2009), therefore it is expected that *P. batesii apsaalooke* or/and *P. b. anasazi* occurs over most of this area (numerous populations must occur in the eastern foothills of the Wind River Mountains), but has not been reported there, due to a lack of collecting plus the difficulty most lepidopterists have in identifying the taxa in the *P. tharos* Drury group (for example, both *P. cocyta* and *P. batesii anasazi* occur over most of the Utah mountains including the Wasatch Range but most specimens remain unidentified). *P. b. apsaalooke* surely occurs in Montana just north of Wyoming in the Bighorn Mountains, Big Horn County, in the Crow Indian Reservation. Good samples and hostplants are desired from all these areas.



Figs. 23 (dorsal)-24 (ventral). *Phyciodes batesii apsaalooke* male, Swift Crk., Afton, Lincoln County, Wyoming, July 13, 74, Arthur O. Detmar (CSUC).

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Euphydryas lectotypes designated by Gunder (1929) (Nymphalidae)

By James A. Scott

Abstract. The lectotype specimens of *Euphydryas* designated and figured by Jean Gunder (1929) are determined.

This paper examines the “types” figured by Gunder (1929) in his important pioneering paper on the taxonomy and genitalic structure of American *Euphydryas*, and determines which of the specimens that he labels as “type” are valid lectotypes, and which are not. Many of the names involve taxa in the CSUC.

Gunder (1929) attempted to figure as many *Euphydryas* types as possible. He stated on p. 2 that “I have illustrated the original types wherever possible”. And on top of page 3 he wrote that some colleagues “Barnes Leussler Van Duzee McDunnough Williams Holland N. D. Riley” loaned him types.

If an author before 2000 singles out one syntype specimen as “the type” in a publication, then that is a valid designation of lectotype, according to the ICZN Code 4th edition, but if two specimens are printed “type” or “types”, then neither is a valid lectotype (see Scott 2008). On his plates, Gunder (1929) usually placed the word “type” in black ink (which looks like typing but is apparently high-quality hand-printed letters because they vary slightly) below two specimens, but the second specimen is nearly always the underside of the same specimen to the left, therefore that inked word type refers to only a single individual. That is obvious, based on comparing the ups and uns photos of each pair of photos and noting the positions of the antennae and the abdomen, or the shape of the V-shaped space between fw and hw, or wing margin shapes and flaws. That comparison clearly shows that the second of Gunder’s paired photos is clearly the uns of the first ups specimen, for Gunder’s *Euphydryas* photos labeled *chalcedona*, *dwinellei*, *colon*, *wallacensis*, *perdiceas*, *paradoxa*, *mcglashani*, *sierra*, *olancha*, *georgei*, *quino*, *ancia*, *helvia*, *brucei*, *bernadetta*, *maria*, *carmentis*, *magdalena*, *alena*, *wheeleri*, *wrighti*, *augusta*, *rubicunda*, *aurilacus*, *nubigena*, *edithana*, *baroni*, *taylori*, *beani*, *hutchinsi*, *montanus*, *lehmani*, and *gillettii*. Therefore I conclude that all of Gunder’s pair of photos represent one individual, even when the absence of odd markings/shapes makes the determination of one individual less clear, except in those obvious cases such as *phaeton* that represent two individuals or one individual that was remounted between photos. In some cases (*capella*, *bernadetta*, *maria*, *carmentis*, *magdalena*, *alena*, *hutchinsi*, *montanus*, *lehmani*) the inked word “type” is below both male and female, but in *carmentis*, *magdalena*, and *alena*

the word is actually under the “holotype male” or “type male” label therefore it is clear that Gunder’s word type and the label refers to the male of the pair, and in *hutchinsi* and *lehmani* the valva is labeled holotype therefore it is clear there is no lectotype designated. He wrote the word holotype or paratype on many of the valva drawings, which also helps determine a possible lectotype designation in many cases. And the photos of specimen labels often have words such as type or holotype and the sex, which help determine whether those specimens are syntypes, as lectotypes can be designated only from syntypes, not from paratypes.

This study agrees with the Gunder lectotypes listed in the Pelham (2008) catalogue, except for the following changes to that catalogue: *rubicunda* is a Gunder lectotype, contrary to Pelham (2008); *bernadetta* is not a Gunder lectotype, contrary to Pelham (2008); *beani* is a Holland (1898 Butterfly Book) lectotype, not a Gunder lectotype, contrary to Pelham (2008); *capella* and *editha* and *gillettii* are almost certainly Gunder lectotypes as Pelham (2008) states, but checking the actual museum specimens and their labels is desirable to confirm this; *mcglashani* is probably not a Gunder lectotype (Pelham 2008 wrote that it is not) and the specimen is currently missing.

Following is a detailed analysis of whether Gunder (1929) validly designated a lectotype for each name on the plates in his paper. Gunder placed the following names on his plates, without generic names, therefore I place them below with the same names in the same sequence:

phaeton (Drury). The words “type *phaeton* male” are below both males, and the second is shown mounted sideways, therefore the two photos evidently represent different individuals unless photos were taken at different times, and the Pelham (2008) catalogue states that the types are lost, therefore evidently not a Gunder lectotype?

phaetusa (Hulst). The words “type *phaethusa*” (spelled with “h”) are below two photos, but both are probably from one individual, but the Pelham (2008) catalogue indicates that the name is infrasubspecific and there is a holotype, therefore not a Gunder lectotype.

chalcedona (Doubleday). The words “type *chalcedona* female” are below two photos but rubbed outer fw proves both are from one individual, therefore it could be the lectotype, as the Pelham (2008) catalogue states, therefore it is a **Gunder lectotype**.

cooperi (Behr). Gunder did not specify that any specimen was “the type” therefore not a Gunder lectotype. Labels below both female and male have the word “type”, therefore both are evidently syntypes. Pelham (2008) wrote that types were destroyed in the 1905 San Francisco, California fire and neotype was designated by Emmel, Emmel, & Mattoon in 1998.

dwinellei (H. Edwards). The words “type *dwinellei* male” are below label written “type” and both photos are the same individual based on truncated abdomen and mismounted wing positions, therefore this appears to be the lectotype, and the Pelham (2008) catalogue states this is lectotype, therefore it is a **Gunder lectotype**.

colon (W. H. Edwards). The words “type *colon* male” are below two photos, but deformed truncated fw and backward-swept wings show that both photos are one individual, therefore this appears to be a lectotype, but the Pelham (2008) catalogue states that Brown (1966) did not identify this specimen as a syntype, Brown (1966) wrote that he could not find the Gunder male in Edwards’ collection, therefore not a Gunder lectotype. Holland (1931) designated the lectotype.

wallacensis Gunder. The words “type *wallacensis* male” are below two photos, but both are probably from one individual, valva drawing has the word “paratype”, but the Pelham (2008) catalogues wrote that Gunder designated holotype in 1928, therefore not a Gunder lectotype.

perdiceas (W. H. Edwards). The words “type (?) *perdiceas* male” are below two photos, both appear to be one individual based on wing positions, but the ? question mark and the statement on text page 4 writing that both are “so-called Edwards’ types”, indicate that there is not a Gunder lectotype. This male specimen was later designated as lectotype by Brown (1966).

paradoxa McDunnough. The words “type *paradoxa* male” are below two photos but truncated forewing and acute angle between forewing and hindwing prove they are same individual, valva figure has the word “paratype”, therefore this could be a lectotype, but the Pelham (2008) catalogue states that there is a holotype, therefore not a Gunder lectotype.

macglashanii (Rivers). The words “type *macglashanii* male” are below two photos, but a nick in hindwing proves both are the same individual, therefore this appears to be a lectotype. The Pelham (2008) catalogue states that the location of type is not known, therefore this is a Gunder lectotype only if the specimen was a syntype; this needs research, which cannot be done if the specimen cannot be located, therefore it currently is **not a lectotype**.

truckeensis Gunder. The words “type *truckeensis* male” are below two photos, and both look like they might be the same specimen based on position of wings though forewing margin appears straighter in second, but the Pelham (2008) catalogue states the name is infrasubspecific and wrote that Gunder (1928) designated holotype, therefore not a lectotype.

sierra (W. Wright). The words “type *sierra* male” are below two photos, but large space between fw and hw and truncated rear of hw prove both are the same individual, therefore appears to be a lectotype, and the Pelham (2008) catalogue states that it is lectotype, therefore this is **Gunder lectotype**.

olancha (W. Wright). The words “type male *olancha*” are below two photos, but hindwing shape and damage to forewing margin prove they are the same individual, therefore this appears to be a lectotype, and the Pelham (2008) catalogue states it is lectotype, therefore this is a **Gunder lectotype**.

georgei (Gunder). The words “type *georgei* male” are below two photos, but wing shapes and positions suggest this is probably one individual, therefore appears to be a lectotype, but *georgei* is infrasubspecific and the Pelham (2008) catalogue states that Gunder (1928) designated holotype, therefore not a Gunder lectotype.

quino (Behr). The word “type” is not present, (both photos are one individual), therefore not a Gunder lectotype.

anicia (Doubleday). The words “type male *anicia*” appear below a female therefore obviously the wrong specimen was illustrated there by mistake, valva drawing has the word “type”. Scott (2014) proved that **Gunder designated lectotype of the individual that was used for the valva drawing**, specifically the specimen that N. D. Riley chose as type and inked its valva drawing that was redrawn left-to-right by Gunder. Gunder’s page 4 wrote “Mr. N. D. Riley of the British Museum made the drawing of the genitalia of the type specimen from which my illustration was made.”

helvia (Scudder). Type word not present on figure, therefore not a Gunder lectotype.

eurytion (Mead). Type word not present on figure, therefore not a Gunder lectotype.

brucei (W. H. Edwards). Type word not present on figure, therefore not a Gunder lectotype.

capella (Barnes). The words “type *capella*” are below the label that has the word “type” and between male (both figures of male appear to be the same individual) and female, and label does not clearly belong to male or female (though surely belongs to the male based on the labels of *carmentis*, *magdalena*, & *alena*), therefore the male is a Gunder lectotype only if the label is from the male, which is almost certainly the case but should be confirmed by examining labels of the actual USNM museum specimens, or if the squiggly on lower label represents the male symbol (the two squiggles look like the male symbol and 8 in my copy which is an original printed copy cut from the printed journal, and the first is evidently not pin holes—a pin hole is above the 8 and another partially obliterates the m of Wm Barnes). Pelham (2008) wrote that Miller & Brown (1981) wrote that the type locality is Manitou Springs (they actually wrote “around Manitou and Denver” [Colorado], preference here given to Manitou Springs, El Patherefore Co., Colorado”) yet the

lower label provides the locality “Platte Canyon”, therefore the Pelham (2008) Catalogue statement that this is a **Gunder lectotype** is **probable**, but the labels of the USNM syntypes should be examined.

bernadetta Leussler. Both male photos are one male based on the small rub on left outer fw margin, the words “type *bernadetta*” are below both the male and female thus Gunder did not single out the male or the female as the “type”, the valva figure has the word “paratype” (which is impossible as no holotype was designated in the original description), and the male abdomen is truncated as if rear had been used for the valva dissection and drawing, thus Leussler evidently sent Gunder only syntypes therefore this is a syntype not a Gunder lectotype even though the Pelham (2008) catalogue states that it is the lectotype. The website <http://butterfliesofamerica.com/> illustrates the same male (the same wing rub etc.) and its label from Monroe Can., Nebraska in OSUC=Ohio State Univ. Collection, and the label photo writes it is a syntype on but the blue border below all 3 photos [ups, uns, labels] wrongly states it is holotype

maria (Skinner). The words “type *maria*” are below male and female, valva figure claims “paratype” (text p. 5 wrote that Mr. Williams illustrated the type genitalia, evidently not the same as Gunder’s genitalia figure labeled “paratype” [paratypes cannot exist when an original description designated no holotype]), and the Pelham (2008) catalogue states that Gunder figured only syntypes, therefore this is evidently not a Gunder lectotype.

carmentis Barnes & Benjamin. The words “type *carmentis*” are below label written “holotype”, and valva figure has the word “paratype”, and the Pelham (2008) catalogue states that Gunder illustrated the holotype, therefore not a Gunder lectotype.

magdalena Barnes & McDunnough. The words “type *magdalena*” are below label written “type”, the two photos of male represent the same individual, but the Pelham (2008) catalogue states that Gunder illustrated the holotype, therefore not a Gunder lectotype.

alena Barnes & Benjamin. The words “type *alena*” are below label written “holotype”, and the Pelham (2008) catalogue states that Gunder illustrated the holotype, therefore not a Gunder lectotype.

wheeleri (H. Edwards). The words “type *wheeleri* male” are below two photos, but positions of wings etc. indicate that both are the same individual, therefore this appears to be the lectotype, and the Pelham (2008) catalogue agrees, therefore this is a **Gunder lectotype**.

morandi Gunder. The words “type *morandi* male” are below two photos, which are probably one individual though the tornus of hw looks a bit different in the two probably due to camera angle, valva drawing has the word “paratype”, permitting this to be a lectotype, but the Pelham (2008) catalogue states that Gunder (1928) designated a holotype, therefore not a Gunder lectotype.

hermosa (W. Wright). The words “type *hermosa*” are below the two photos of male, which appear that they be the same individual based on wing positions, and the valva drawing has the word “type”. The Pelham (2008) catalogue states that the male is a Gunder lectotype, which would be true if Gunder took a photo before he wrecked the abdomen to make a genitalia drawing labeled “type”, which is confirmed by the photos of the identical male (same chip on right hw etc.) at <http://butterfliesofamerica.com/> (ups, uns, and labels) which shows the abdomen shorter (because the abdomen tip containing genitalia was removed) than the Gunder figure (one of the labels incorrectly writes that this was designated the lectotype by J. W. Tilden 1975), therefore this is clearly a **Gunder lectotype**. (The *wrighti* and *beani* entries evidently also confirm that Gunder took photos before breaking and dissecting the abdomen for valva drawing.)

irelandi Gunder. The words “type *irelandi*” are below two photos of the male, which probably represent the same individual, valva drawing has the word “holotype”, and abdomen appears slightly truncated as if the abdomen tip had been broken off to examine and draw the valva, therefore the male is evidently the holotype as noted by the Pelham (2008) catalogue, but the

Pelham (2008) catalogue states that Gunder designated holotype in Can. Ent., therefore not a Gunder lectotype.

editha (Boisduval). The words “type *editha* male” are below two photos, but both appear probably like one individual based on wing positions, therefore could be the lectotype, but the Pelham (2008) catalogue states that Emmel, Emmel, & Mattoon (1998) designated the lectotype (their figure of their lectotype male differs from Gunder’s male, but they did not mention Gunder), therefore this male is evidently not a syntype, therefore **probably not a Gunder lectotype, unless Gunder’s male matches the second male syntype mentioned by Emmel, Emmel, & Mattoon (1998), in which case Gunder designated the lectotype.**

wrighti Gunder. The words “type *wrighti* male” are below two photos, which are one individual based on pale fringe flaw on fw tornus and hw shape and wing positions, valva figure has the word “holotype”, therefore might be a lectotype, although the abdomen looks intact (not broken for KOH dissection), but Gunder in this paper p. 5 designated a holotype, therefore not a Gunder lectotype. The male photo is evidently of the holotype, therefore this entry and the *hermosa* and *beani* entries evidently prove that Gunder took photos before breaking and dissecting the abdomen for valva drawing.

augusta (W. H. Edwards). The words “type *augusta* male” are below two photos, but positions of wings and the way the body was chopped off the wings in the underside photo proves both are of the same individual, therefore this appears to be the lectotype, but the Pelham (2008) catalogue states that Brown (1966) designated lectotype of this W. H. Edwards name, and Brown (1966) wrote that he could not match Gunder’s specimens with any present in Edwards collection in CMNH, therefore perhaps this is not a syntype, therefore probably not a Gunder lectotype.

monoensis Gunder. The words “type *monoensis* male” are below two photos, but positions of wings suggest they are probably the same individual, valva drawing has the word “paratype”, and the Pelham (2008) catalogue states that Gunder (1928) designated holotype, therefore not a Gunder lectotype.

rubicunda (H. Edwards). The words “type *rubicunda* male” are below two photos (mostly below one male), but the two photos are surely one individual male based on wing shape. Both locality labels have the word “type” therefore both must be syntypes, therefore this appears to be a lectotype. The Pelham (2008) catalogue states that Holland (1898) figured the “type”, but actually neither the text nor plate 16 in Holland (1898) have the word “type” (as Scott 2008 reported), therefore Holland did not designate a *rubicunda* lectotype, and the figures in Holland (1898) and Gunder differ in appearance. Therefore this is not a Holland lectotype, the male is clearly a **Gunder lectotype, contrary to the Pelham (2008) catalogue.**

aurilacus Gunder. The words “type *aurilacus* male” are below two photos, and wing shapes clearly prove both photos are of one individual, therefore this appears to be a lectotype, but valva drawing has the word “paratype” and the Pelham (2008) catalogue states that Gunder designated holotype in 1928, therefore not a Gunder lectotype.

nubigena (Behr). No figured use of the word “type”, therefore not a Gunder lectotype.

edithana (Strand). The words “type male *edithana*” are between two photos, but a nick on hindwing proves both are of the same individual, therefore this appears to be a lectotype. P. 7 says “I sent to Berlin and secured photos of the type of *edithana* Strd.”, and the Pelham (2008) catalogue agrees this is a Gunder lectotype, therefore **Gunder lectotype.**

baroni (W. H. Edwards). The words “type *baroni* male” are below two photos, but both are evidently one individual based on wing shape, therefore appears to be a lectotype, but the Pelham (2008) catalogue states that Brown (1966) designated lectotype of this W. H. Edwards name, and Brown (1966) wrote that Gunder’s specimens were not syntypes, therefore not a Gunder lectotype.

colonia (W. Wright). The words “type male *colonia*” are below two photos, which are evidently of the same individual as middle of outer fw margin is weaker in both, therefore appears to be the lectotype, and the Pelham (2008) catalogue agrees this is lectotype, therefore a **Gunder lectotype**.

taylori (W. H. Edwards). The words “type *taylori* male” are below a photo of a male, and near another photo which is clearly one individual based on nick on hw etc., the male label and female label both have the word “type” therefore both must be syntypes, the Pelham (2008) catalogue states that it is a Gunder lectotype, therefore this is a **Gunder lectotype**. Brown (1966) later incorrectly designated a lectotype for this same Gunder male specimen.

beani (Skinner). The words “type male *beani*” are below two photos, but clearly both are of the same individual based on antenna and abdomen position etc., valva drawing has the word “holotype” [even though there was no holotype], therefore this appears to be the lectotype, and the Pelham (2008) catalogue agrees, therefore it would be a Gunder lectotype, except that Holland (1898) designated a lectotype earlier. (This with the *hermosa* and *wrighti* entries also suggests Gunder took photo before breaking and dissecting the abdomen to get valva drawing, he did not merely brush abdomen because on text p. 2 Gunder wrote that he pressed the valva on slides and used a Spencer Drawing Machine to make the drawing.) This is a Holland (1898) lectotype.

hutchinsi McDunnough. The words “type *hutchinsi*” are below both male and female, valva drawing has the word “holotype”, and the Pelham (2008) catalogue states that there is a holotype (N. Kondla has photos of holotype, personal communication), therefore not a Gunder lectotype.

montanus McDunnough. The words “type *montanus*” are below both male and female, valva drawing has the word “paratype”, the Pelham (2008) catalogue states that there is a holotype (N. Kondla has photos of holotype, personal communication), therefore not a Gunder lectotype.

lehmani Gunder. The words “type *lehmani*” are below both male and female, valva drawing has the word “holotype”, and the original description text p. 7 states that there is a holotype, therefore not a Gunder lectotype.

gillettii (W. Barnes). The words “type male *gillettii*” are below two photos, which are evidently of the same individual based on wing shapes especially the flattened front of fw apex, label to right has the word “type”, and the Pelham (2008) catalogue states that this male is a Gunder lectotype, therefore it is a **Gunder lectotype assuming** the label belongs to the male rather than the female, which is a reasonable assumption, but should be checked on the actual museum specimens (evidently in USNM).

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Two Subspecies of *Euphydryas* “*anicia*” from the Chuska Mountains, New Mexico/Arizona (Nymphalidae)

Abstract. Two different subspecies of *Euphydryas* “*anicia*” in the Chuska Mountains of Arizona-New Mexico do not intergrade because they are allopatric and allochronic.

Euphydryas anicia chuskae Ferris & Holland occurs in at least eight sites in the Chuska Mountains. The upperside resembles *E. anicia capella* (Barnes) from the Front Range of Colorado, but the ventral hindwing reddish bands are filled with tan centers with cream margins (making each postmedian and postbasal spot look like a corn kernel), similar to *E. anicia carmentis* (Barnes & Benjamin) of southwestern Colorado. Thus *chuskae* shares traits of *capella* and *carmentis*. The type series was from 3-5 miles above (NNW) Toadlena, ~7700', in San Juan County, New Mexico (Ferris & Holland 1980). They reported that it occurs only above 7500', and peak flight is in the last week of June (157 specimens were collected June 27, 1978 by C. D. Ferris). Adults were associated with *Penstemon strictus*. Specimens in CSUC from Chuska Mts., coll. R. W. Holland: near Sanostee [way west actually, because Sanostee is on the plains], San Juan County New Mexico=SJ, 8000', June 23, 1974 6m3f; 6 mi. northwest of Toadlena, Navajo road #19, SJ, July 3, 1978 2f; 8 mi. northwest of Toadlena, SJ, June 22, 1974 1f; 5 mi. northwest Toadlena, SJ, July 3, 1978 1m; 10 mi. up Tsaille Creek from Wheatfields Lake, Apache Co. Arizona=AP, July 8, 1978, 5m; 8 mi. north Wheatfields Lake, Tsaille Creek, AP, June 29, 1974 1m; 5 mi. west Toadlena, AP, June 22, 1974 3m; Roof Butte [maybe 9000' at collection site], AP, June 29, 1974 1m.

Therefore, the two subspecies do not fly together because *hermosa* flies at lower altitude (5500-6800'), and earlier in the season (April 30-June 15) than *chuskae* (7500-9000', the short flight June 22-

July 8 with peak flight last week in June). Actually, *E. a. hermosa* flies earlier than other subspecies throughout northern Arizona and southern Utah.

If a splitter wanted to assign these two subspecies to two different species, it would be tempting to name them *E. bernadetta chuskae* and *E. anicia hermosa*, because *E. bernadetta* Leussler acts like a species in Montana and Alberta where it is nearly sympatric with other *E. anicia* subspecies, and in the Laramie Range of southern Wyoming and northern Larimer County, Colorado collectors have thought that the whitish *bernadetta* is intergrading with the orangish *E. anicia eurytion* Holland 1931 and *E. anicia capella* because orangish adults appear along with the majority whitish adults. If that were true, we could happily use the names *E. bernadetta capella* and *E. bernadetta carmentis* and *E. bernadetta chuskae* and *E. bernadetta cloudcrofti*, which would nicely separate them from *E. anicia hermosa*. However, Steve Spomer found that the larvae of those “intergrades” in southern Wyoming are black-with-white stripes like *bernadetta*, not white like the larvae of *eurytion* and *capella* and *cloudcrofti*, therefore those southern Wyoming-north Larimer County butterflies actually would seem to be just *E. bernadetta rorina* Scott & Fisher which occurs over most of the western slope of Colorado and always contains a minority of orangish adults among the predominantly whitish population. Therefore the names *E. anicia eurytion* and *E. anicia capella* and *E. anicia carmentis* and *E. anicia chuskae* may be more correct. And *E. anicia cloudcrofti* has a rather whitish larva similar to *E. a. eurytion* and *E. a. capella* (USFWS et al. 2004) and its adults resemble *E. a. capella*. And as noted above, *chuskae* and *hermosa* are not really sympatric and synchronic in the Chuska Mountains (or that happens quite rarely).

The *E. chalcedona* group of taxa containing all these taxa and many more, is very complicated, as the genitalia varies considerably and intergrades completely, wing pattern varies enormously and every intermediate occurs, hostplants vary greatly and there are local and regional preferences, mate-locating behavior varies from hilltopping to gulching in various taxa and some populations fleek a lot, larvae vary greatly in color pattern and are involved in mimicry with *Euphydryas editha* (Boisduval) and some moths, flight time and number of generations vary greatly, etc. (Scott, 2006). Overall, there is a definite shortage of instances of sympatry and synchrony between different taxa, therefore lumping them all into one “stenchospecies”=superspecies is well justified, while authors of local books may want to treat some taxa as “bookkeeping species”=semispecies because they behave more like species in their local area. Perhaps the best choice is for each author to give them both names simultaneously; that matches what the butterflies show us. The butterflies themselves care absolutely nothing about the names that humans give them.

I note here that if one were to divide all the New Mexico-Colorado butterflies into two species, the first division would be to separate *Euphydryas anicia brucei* (W. H. Edwards) away from all the others, because it has a nearly-solid black larva quite different from the others (Scott 2008, plus recent rearing by Steve Spomer), and the adults are small and dark and live in the alpine-subalpine zone in a habitat quite unlike any of the others, where they are evidently multiannual (larvae usually overwinter multiple years). *E. a. brucei* adults are generally small and dark, however they vary considerably and some extremes look orangish or whitish or black etc. like many other subspecies.

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Nymphalis californica (Nymphalidae) Subspecies in New Mexico (Nymphalidae)

Abstract. Two different subspecies of *Nymphalis californica* seem to occur in New Mexico.

The phenotype in Arizona is poorly known. Scott & Kondla found two females from the Chiricahua Mountains in southeastern Arizona to be *timidar* like those in southwestern New Mexico, and one specimen from the Hualpai Mountains in northwestern Arizona resembled *timidar*. But two specimens in the Hualpai Mountains in CSUC are strongly striped *N. c. californica*. The Hualpai Mountains and possibly most of northern Arizona may have phenotypes similar to those in Utah, nearest ssp. *californica*.

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***Apodemia* “*mormo*”-group variation, especially in New Mexico, Colorado, and in Sonora, Mexico (Riodininae, Lycaenidae)**

by James A. Scott

Abstract. Several “species” of *Apodemia* “*mormo*” seem to intergrade in New Mexico and Colorado. A new segregate from Sonora, Mexico, is described. The taxa of *A.* “*mormo*” are discussed, and the usefulness of mtDNA to determine butterfly phylogeny is discussed. The type locality of *A. m. mejicanus* is discussed and suggested.

Introduction. The variation within this *A.* “*mormo*” (Felder & Felder) species or superspecies is quite complex, especially in California. The CSUC contains many California specimens collected by Ken Davenport. Even in the Rocky Mountains and New Mexico there are complexities and puzzles as shown by specimens in the CSUC. These “*mormo*” butterflies are not as host-specific to individual species of *Eriogonum* as are most *Euphilotes* host races. Some taxa or sets of populations have just one generation either in spring or late summer, and some taxa have several generations. There are some cases of sympatry of different phenotypes of “*mormo*” ssp., but they usually seem to involve allochrony, which suggests that there may be just one species, with various hostplant races that use different *Eriogonum* hostplants at different times. The *tuolumnensis* Opler & Powell and *cythera* (W. H. Edwards) subspecies have been placed in another species but are now known to intergrade with the subspecies *mormo* kinds in Santa Barbara County and on the eastern side of the Sierra Nevada (Lower Rock Creek Road, Mono Co. etc.) respectively. Many taxa have been considered to be subspecies of *Apodemia virgulti* (Behr). Even the Mojave Desert *deserti* Barnes & McDunnough would seem to be a subspecies of *virgulti*, because *mojavelimbus* J. Emmel, T. Emmel & Pratt--which occurs on hills all along the western edge of the Mojave Desert--seems to be just a *deserti* with the orangish patch on forewing darkened to reddish-orange evidently due to intergradation between reddish-orange *virgulti* and orangish *deserti*; in addition, *deserti*-like variants pop up as individual variants within *virgulti* subspecies near the Mojave Desert and in whole populations in the Kern River Valley area (Davenport, 2014) which is now considered harbor various intermediate populations, and *deserti* seems to intergrade with *virgulti* in Baja California, Mexico (Brown et al. 1992). Also, the whitish “*dialeucoides*” J. Emmel, T. Emmel & Pratt kinds in California seem to be related to and intergrade with the near-*virgulti* (Behr) kinds in Baja California (*dialeuca* Opler & Powell etc. is about half as whitish as *dialeucoides*), and the enlarged white spots in *deserti/pratti* J. Emmel, T. Emmel, and Pratt/*mojavelimbus* seem to link those taxa with the *dialeuca* kinds, and the “*mejicanus*” from Sonora are also a little whiter as noted below. There may be at most just two species *A. mormo* and *A. virgulti*, or just one because evidently nowhere do two “*mormo*” group taxa fly together at the same time and place (some *virgulti* varieties occur in close proximity to some *tuolumnensis* populations in Kern County), while there are many localities where different phenotypes resembling named subspecies occur as variants within variable populations. A major problem with the subspecies now used within *A.* “*mormo*” is that there are relatively few wing pattern characters involved, therefore some of the geographic variants may have developed similar appearance through independent origins in different localities.

Intergradation in Colorado-New Mexico. The Colorado-New Mexico *A.* “*mormo*” group butterflies show interesting variations also and seem to suggest there is just one species, rather than the two species that could be deduced from studying the California butterflies. Richard W. Holland accumulated numerous specimens from New Mexico and vicinity (Holland 2009) that are now in CSUC. Forbes (1981) also studied New Mexico and southern Arizona populations. *A. mormo mormo* occurs in the Gallo-Mangas Mountains and White Mountains of southwestern New Mexico-Arizona, and Holland (2009) thought that area and the Gila Mountains has intergradation between subspecies *mormo* and *mejicanus* (Behr). *A. mormo mormo* ranges north and northeast to the Chuska, Zuni, and Jemez Mountains and San Juan and Sandoval and McKinley and Rio Arriba Counties in northern New Mexico

(and all over western Colorado), and has one generation in late summer. The subspecies *mejicanus* occurs all across southern New Mexico from the Peloncillo Mountains to the Sacramento Mountains and Carrizo Peak, and based on Holland's specimens extends northward to the Magdalena, San Mateo, Manzano, and Sandia Mountains and Ladron Peak, New Mexico; it has several generations. Subspecies *pueblo* occurs east of the continental divide in Colorado and in southern Wyoming with just one generation (northward in South Dakota-North Dakota-Montana and Saskatchewan, subspecies *mormo* occurs on *Eriogonum pauciflorum*, and oviposits 2-4 eggs on lower leaves & stems except in Saskatchewan where it oviposits single eggs on soil or rocks nearby, Wick et al. 2012). Ssp. *pueblo* has orangish-red on dorsal forewing and on the postmedian band of dorsal hindwing but less on the inner areas of dorsal hindwing, whereas subspecies *mejicanus* has those same orangish-red areas and adds much orangish-red on the base and middle of dorsal hindwing. Using that definition of subspecies, a male 6 mi. north of Raton Pass in Las Animas County, Colorado and 2m4f north of Folsom in Union County, New Mexico are *mejicanus*, although there is evidently just one generation there which fits ssp. *pueblo* rather than *mejicanus*. Subspecies *pueblo* occupies the northern part of the San Luis Valley on *Eriogonum jamesi*, but at Del Norte in Rio Grande County, Colorado and 7 mi. west La Garita in Saguache County, Colorado it intergrades with *A. m. mormo* (the reddish on dorsal hindwing varies from present to absent). *A. m. mormo* extends eastward around the southern end of the San Juan Mountains in northern New Mexico to populate the southern part of the San Luis Valley, on *E. microthecum* at some sites. Ssp. *mormo* records: Manassa, Costilla County, Colorado July 31, 1987; 7.5 mi. east Fort Garland, Hwy. 160, Costilla County, Aug. 10, 2009 (but east of there at 4.5 mi. WSW N La Veta Pass in Costilla Co. July 21, 1997, A. Warren found ssp. *pueblo* assoc. *Eriogonum jamesi*); County road H, 0.75 mi. west Hwy. 159, Costilla County, Aug. 19, 2009; all on specimens shown at <http://butterfliesofamerica.com/>; ssp. *mormo* San Luis, Costilla Co., Aug. 27, 1967, R. E. Stanford 1m; and ssp. *mormo* just southward Chawa Lama Overlook, east side Rio Grande Gorge, Taos County New Mexico 7000', Aug. 24 1985 R. W. Holland 3m5f (both records CSUC), which is evidently north of Questa considerably north of Taos. Then southward on the eastern side of the Rio Grande in Taos County, near Questa most adults look like *pueblo* but some resemble *mormo*: near Cerro, July 27 1985 S. J. Cary 1m *pueblo* (CSUC); Big Arsenic Spring, Aug. 9, 1986 S. J. Cary 1m near ssp. *mormo* and 1m2f *pueblo* (CSUC); same site Aug. 13, 1996 J. Scott 1m *pueblo* and 1m1f intermediate with only ½ the uph postmedian orangish)(in Scott coll.). Then higher up into the Sangre de Cristo Mountains of Taos County most seem to resemble *pueblo* (7.5 mi. west Twining, Hondo Canyon Aug. 20, 1964 Mike E. Toliver 1f *pueblo*; Arroyo Hondo 1 mile northeast of National Forest boundary 7500' R. W. Holland 3m *pueblo* (both CSUC); ~4-5 mi. southwest Palo Flechado Pass at Tienditas Creek, Aug. 23, 1979 J. Scott 1m *pueblo* [in Scott coll.]). Those specimens suggest that *A. m. mormo* intergrades with *pueblo*, but if it is intergrading with *mejicanus* in those New Mexico sites, some individuals would resemble pure *mormo* and others would resemble *pueblo* simply because any *mormo* X *mejicanus* mating would produce adults with less reddish and thus would look more like *pueblo*, therefore they may be intergrading with *mejicanus*. Because *mejicanus* is evidently a subspecies of *A. virgulti*, this represents intergradation between two "species" *A. mormo* and *A. virgulti mejicanus* (or *A. mejicanus* for some people). But we should probably interpret all of them as just one "species" (stenchospecies = superspecies) *A. mormo*.

Proshok et al. (2015 p. 7 end) reported that the DNA of subspecies *pueblo* from Colorado is rather distinctive, yet the museum specimens show that it intergrades with subspecies *mormo*. I named *pueblo* as a subspecies of *mormo*, and Proshok et al. merely used the name *A. mejicanus pueblo* by copying the name from a checklist that misclassifies numerous North American butterflies.

The taxon *duryi* (W. H. Edwards) seems to be a regional variety or subspecies of *mejicanus* from the area of the Organ Mountains of Doña Ana County, New Mexico southward into Mexico in northern Chihuahua etc., which has more orange on upperside, and some specimens from the eastern side of the Guadalupe Mountains are also that phenotype. Eastward in the Davis Mountains Texas and just

southward ordinary *mejicanus* occurs. It is difficult to decide whether many Texas and New Mexico specimens are *duryi* or *mejicanus* because they are not very distinct there and many specimens look intermediate, and as a result most of the New Mexico and adjacent Texas specimens that have been identified as *duryi* are females because they show a greater amount of orangish than male *mejicanus*. But Holland (2009) recorded ssp. *duryi* from the Chisos Mts. of SW Texas, and photos of Chisos Mts. adults at Butterfliesofamerica.com show many distinctive yellowish-orange *duryi* specimens; evidently populations of the distinctive extensive-yellowish-orange pure ssp. *duryi* occur in Chisos Mts. southward to the state of Queretaro in central Mexico, whereas the New-Mexico and northern West Texas populations of “*duryi*” are intergrades with *mejicanus* and are not pure *duryi*. Jack Harry found multiple oviposition on *Krameria glandulosa* for “*duryi*” in western Texas (30 mi. N Van Horn, Culberson Co. Texas April 12, 1973, and SW base Guadalupe Peak, Culberson Co. Texas May 3, 1973) and reared eggs from the latter locality on *K. glandulosa* (Kendall 1976 who reported them as *mejicanus*, and J. Harry 1974 Lepid. News #2 p. 8), and New Mexico near *duryi* populations may eat that plant. But females of ssp. *deserti* at Sheephole Pass California showed interest in *Krameria* and larvae from there were reared on *Krameria* (Pratt & Ballmer 1991), therefore that hostplant does not justify treating *duryi* as a separate species. Proshek et al. (2015) did not study any “*duryi*” populations.

DNA study. Proshek et al. (2015) studied the mtDNA COI and six microsatellite loci of 447 specimens of *A. “mormo”*-group across the range, and the variation they found did not match the named subspecies. Instead, the variation mostly reflected geographic proximity, as the Pacific Northwest assemblage of populations was distinctive, as was a cluster in Saskatchewan-northern Wyoming and another cluster in Colorado, while the California populations had a mess of polymorphic mtDNA and polymorphic microsatellites which showed little concordance between them, indicating to me that considerable interbreeding and random sequence changes occurred between the various populations and phenotypes in California. Overall, they provided no evidence that there is more than one species in the complex, as considerable interbreeding was evidently necessary to produce the results they found, and that interbreeding was only slowed by large distances between populations in the far northern and far eastern parts of the *A. “mormo”* group overall range in North America.

The usefulness of mtDNA for the study of butterfly phylogeny. Because the mtDNA and microsatellite variation does not correspond with the named wing pattern subspecies, should we discard those named subspecies? I think not. My definition of a subspecies is any population(s) that differs in pattern or structure that can be seen by the ordinary person—the traditional definition of butterfly subspecies. I simply ignore useless geneticists’ results such as this and continue onward. A butterfly has thousands of genes, and most of them will not show the same pattern of geographic variation as the wing pattern. To expect every stretch of DNA or gene randomly selected by geneticists to show the same variation as the wing pattern is ridiculous. Each gene is expected to have some function in the animal’s biochemistry or life style, therefore it is logical to expect that each gene will show its own unique geographic and phylogenetic variation influenced most strongly by that function. When geneticists sequence some random stretch of DNA, and find that it does not match the geographic wing pattern variation of the butterflies, they should not pronounce the named subspecies to be bogus. They should be attempting to determine the function of that stretch of DNA, and then they would be able to determine how it might be expected to vary geographically with changes in climate or habitat etc. If geneticists want to study phylogeny, they should determine the stretches of DNA that produce the proteins that make the pheromones of male and female butterflies, because those pheromones seem to be the basis of the reproductive isolating mechanisms of essentially all the Lepidoptera, both butterflies and moths. Today the geneticists fail to study those stretches of pheromone DNA, and very few people today study pheromones, and therefore they fail to provide the desirable genetic evidence that is most relevant to the study of speciation and phylogeny. And vision is often important in courtship and mating, which suggests that the conspicuous visible wing pattern of butterflies is much more likely to correlate with speciation

and phylogeny than some random small stretch of DNA selected by geneticists merely because it is cheap to sequence.

Nick Grishin (personal communication) has found that mitochondrial DNA is useful for the study of phylogeny of many butterfly species, but is not ideal for the study of phylogeny of very-recently-evolved butterfly taxa, which generally involves just random variation. A. “*mormo*” seems to be a good example because they still seem to be evolving local races. Unfortunately, the mtDNA COI sequence has proven to be useless or misleading in numerous butterfly studies including my own study on *Phyciodes* (Wahlberg et al. 2003). Most *Phyciodes tharos* (Drury) group species proved to be polymorphic and overlapping in mtDNA haplotypes, therefore the study was mostly unhelpful. And the mtDNA of *Polygonia progne* (Cramer) is similar to that of *P. interrogationis* (Fabricius)/*P. comma* (T. Harris), but I found that everything else about *progne* proves conclusively that it is the sister species of *P. oreas* (W. H. Edwards), as they share the same male genitalia, the uniform blackish underside, every detail of larval color pattern, *Ribes* hostplants, the slow flight, the rarity everywhere, and their ranges are parapatric and overlap only a few km (Scott & Kondla, 2014). Another example is *Papilio eurymedon* Lucas, whose mtDNA is identical to that of *P. glaucus rutulus* Lucas (Grishin, personal communication) yet they can be easily distinguished and fly together in most of the mountains of western North America and no hybrids are known to me. In *Argynnis* (*Speyeria*), mtDNA sequences produced a phenogram in which the various proven species were often scattered nonsensically among other species (McHugh et al. 2013—who misidentified some specimens), see Guppy et al. (2014). In the *Oeneis bore* (Esper) group (Warren et al. 2016), mtDNA failed to distinguish the distinctive species *O. alberta* Elwes from other species, and wrongly separated the very similar species or subspecies *O. nevadensis* (C. Felder & R. Felder) and *O. macounii* (W. Edwards) (“most likely due to a mitochondrial introgression” was the explanation for this failure), placed *O. bore* specimens all over the phenogram mixed up with other taxa {their dendrogram Fig. 9 shows a thoroughly shuffled jumble of American and Russian taxa including many probably-misidentified *chryxus* (Doubleday)/*altacordillera* Scott, therefore mtDNA seems to be useless in the *O. bore* group}. {They named *O. calais tanana* from Alaska as a “species” *tanana* Warren & Nakahara; it looks similar to *O. calais altacordillera* Scott and *O. calais caryi* Dyar on upperside but has whiter unh median band edges evidently due to introgression with *O. bore* (Esper) and some *tanana* types even look like misidentified *O. bore*--note that at the opposite southern end of the *O. c. altacordillera* range in New Mexico, *O. calais socorro* Holland has the least amount of white on the unh median band (Scott 2014). *O. c. tanana* would seem to be conspecific with *altacordillera* and some specimens share mtDNA of some Yukon *O. calais* (Scudder) near-*caryi* variants (Warren et al. 2016); it cannot be a “hybrid species” as claimed because the introgression-source *O. bore* is still present in the area.} The mtDNA has also failed to help classify the difficult genus *Colias*. And mtDNA is virtually useless to study Polyommastini (Lycaenidae) phylogeny, because it is nearly identical in most or all Nearctic taxa (Grishin, pers. comm.).

A major problem with mtDNA is that just a little hybridization can quickly spread “sweep” through the entire population and taxon because of its maternal inheritance, producing a misleading impression of the phylogeny. Just as the technique of electrophoresis quickly disappeared once gene sequencing became cheap, mtDNA sequencing is also doomed to disappear for the study of phylogeny within the next few years, because the cost of whole-genome DNA sequencing is now only ~\$35. per insect and is dropping fast.

Sukumaran & Knowles (2017) found that the phenogram analysis performed in many DNA phylogeny studies (the multispecies coalescent) does not distinguish between population isolation versus species boundaries, and predicts five to 13 times as many “species” as traditional taxonomists report, therefore they suggest that such genome analysis should be only a hypothesis, which requires validation with phenotype and ecological information.

Whiter segregate of subspecies *mejicanus* in Sonora, Mexico. Notable here is a distinctive phenotype of subspecies *mejicanus* that seems to occur over most of the state of Sonora, Mexico. Adults

have essentially the same extensive amount of reddish-orange as subspecies *mejicanus*, but the white spots are a little enlarged. Individual specimens are not very noticeably different (not quite different enough for me to name them as a new subspecies), but in whole unit trays full of specimens this whiter difference is quite noticeable. Specimens in CSUC, all from Sonora: San Carlos, April 30, 1978 3f giant size. Vicinity Nacopuli Canyon, San Carlos, March 25-26, 2000, Jim Brock 4m2f. Nacopuli Can., 5 mi. north San Carlos, March 23, 2004, P. and E. Opler 10m. 17 mi. southwest of Moctezuma, July 13, 1986, D. D. M., 1f. West of Cananaca, Hwy. 002, March 22, 2003, P. Opler & H. Brodtkin, 1m. Powerline Hill, 5200', Hwy. 2, 1 mi. west Cuitaca, March 20, 1998 Ray E. Stanford, 4m. 3 mi. west Cuitaca, Hwy. 2, P. & E. Opler, March 2, 1904 1m, March 19, 2004 3m. 1 mi. west Cuitaca, km 109-110, Hwy. 2, Feb. 28, 2003, P. Opler, E. Buckner. Las Avispas microwave relay, 70 km north of Guaymas, 1000', Oct. 18, 1986 Douglas Mullins, 10m1 1f.

Type locality of *mejicanus*. A problem with naming those Sonora, Mexico, butterflies is that the type locality of the name *mejicanus* is dubious. And the *mejicanus* types were destroyed in the 1906 San Francisco earthquake and fire (Pelham, 2008). Herman Behr (1865) wrote in the original description that the type locality is "the Sierra Madre, in the neighborhood of Mazatlan" which is in the state of Sinaloa, Mexico. To my knowledge, *A. mormo* has never been collected in Sinaloa, Mexico, and Nick Grishin (personal communication) has not found any *A. mormo* from Sinaloa in his visits to many museums to photograph types. Therefore if it was mislabeled the type locality has to be Sonora, Mexico, or Arizona (as noted by Scott, 2008, p. 34), unless it was actually taken inland from Mazatlan on the eastern side of the mountains in the state of Durango, which location is likely to be in the range of ssp. *duryi*. The original description (Behr 1865) of *mejicanus* and *dumeti* Behr (currently considered to be a synonym of *mormo*) and *virgulti* Behr were all in Latin. Behr's *mejicanus* description follows:

"N. *Mejicanus*, Behr.

Alae supra fulvae, marginem versus brunneae, fasciis maculisque ordinariis omnibus albis nigro marginatis instructae. Subtus alae anteriores fulvae, apice et margine grisescentes, fasciis et maculis ut supra. Alae posteriores grisescentes, maculis albis et nigro marginatis et confluentibus cum colore universali irregulariter variegatae."

Using a Google.com translation and a Latin dictionary, I translated that into the following biological English:

Wing uppersides reddish fulvous [same color as Behr's description of *virgulti*], the margin brown, with the usual spot bands and spots white with black edges. Forewing underside fulvous, apex and margin pale gray, the bands and spots like the upperside. Hindwing underside pale gray, the spots white with black edges on a background of irregularly-variegated colors.

And Behr stated in English that "the most positive and striking points of difference" for *mejicanus* are:

"2. N. *Mejicanus*. All wings are occupied with it [fulvous, the same fulvous color as Behr's *dumeti* and *virgulti*], till beyond the second band, where the brownish coloration of the margin begins. Bands and spots perfectly white."

Behr's Latin and English descriptions are rather generalized. Neither *mejicanus* nor the Sonora *mejicanus* nor *duryi* have the postmedian upf band of spots perfectly white (it is always full of some fulvous), and the extensive area of fulvous described could fit either *mejicanus* or *duryi*, but the words he used for the color of *mejicanus* "fulvae, fulvo, fulvous" are the same as the words he used for *virgulti*, which suggests that Behr's type specimen was from Arizona or Sonora *mejicanus*, and not from ssp. *duryi* which mostly has a yellower tint of fulvous than the reddish-fulvous of *mejicanus* and *virgulti*. If someone were to consider the Arizona and Sonora butterflies to be different nameable subspecies and designates a neotype, either one could be named, but nomenclatural stability would result if the Sonora bug were named.

Therefore, based on that meager evidence, and the fact that the most popular usage of the name *mejicanus* has been for Arizona butterflies, I suggest that the Huachuca Mts. of southern Arizona (where ordinary *mejicanus* occurs at lower elevations) is a good suggested TL to match the original description and avoid instability in nomenclature. A correct type locality requires “proof of origin of the name-bearing type”, so I have used the available evidence of known distribution of the species and the original description plus the ideal of nomenclatural stability to select that **suggested type locality of lower Huachuca Mts.**

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distribution at and near the gigantic Yellowstone caldera that occupies much of Yellowstone National Park, which erupted 2.1 million, 1.3 million, and 640,000 years ago, producing thick deposits of volcanic ash that fell as far away as Iowa, Louisiana, and California. Since the last eruption, 30 outflows of lava have filled the >100km-diameter caldera (source USGS internet summary).

The butterflies *Coenonympha haydeni* (W. H. Edwards), *Boloria kriemhild* (Strecker), and *Euphydryas gillettii* (Barnes) (all Nymphalidae) have ranges roughly centered on the crater, therefore wind may have blown ash thick enough to smother most of their populations. They somehow managed to survive and repopulate from populations upwind of those ash falls.

Comparison to other ssp.: *Lycaena florus florus* type locality is Garnett's Ranch, near Lundbreck, mouth of Crowsnest Pass, Alberta, defined by Kondla & Guppy (2002) who illustrate the lectotype that has one orange lunule; *L. f. florus* has more orange than *L. f. caldera*, as the numerous *L. f. florus* males from near the type locality average ~2.0 narrow lunules on dorsal hindwing (Fig. 35), and the upf of females varies from little orange to mostly orange. Additional specimens of *L. f. florus*: in Scott coll., a male 9 mi. east of Morley (which is east of Banff Park), Alberta has two orange lunules; two females near Kananaskis Lakes, Alberta are 2/3 orange on upperside; on photos at <http://butterfliesofamerica.com/>, a male from Lake Sherbourne 5000' in Glacier National Park in Montana has two lunules, a female near St. Mary in Glacier County, Montana has 1/4 orangish-cream upf, and a female from Banff, Alberta has 1/3 orange upf and 3 1/2 lunules; in Kondla collection, a male from Chief Mtn. Highway in Waterton Lakes National Park, Alberta has no orange. *L. f. megaloceras* Ferris from the Bighorn Mountains of Wyoming and the Crazy Mountains and Little Belt Mountains and other ranges in central Montana, has few orange lunules (averaging 1.2 in 8 males), but differs from all other subspecies by having females with the orangish dorsal markings on upf and the center of uph replaced by cream, even on fresh females. The Bear Paw Mountains in Hill County in north-central Montana probably also has subspecies *megaloceras* (9m from Rocky Boy Ski Hill Aug. 7, 1982 N. Kondla average ~1 weak lunule), but no females were seen to determine whether they have the cream ups of fresh *megaloceras* females. Some lower-altitude adults north of Yellowstone from 4-Mile Creek, Boulder River Canyon, Sweet Grass County, Wyoming may be close to *megaloceras* as the paler areas on the upf of several females are slightly cream-colored. *L. f. florus* also occurs southward in Wyoming and northern Colorado: on the eastern slope of the Wind River Mountains in Wyoming *L. f. florus* has several lunules on males and the female upf is 1/2-orange to sometimes mostly-orange: specimens from Ross Lake Meadow, Fremont County, ~9650', 26-vii-85, L. Frank 1m with one lunule, and same locality and date coll. L. Snyder 1m 3.5 narrow lunules, both in CSUC; Dickinson Park to 1.2 mi. west, 9300', Sublette County Aug. 15, 1983, 12m3f in Scott coll.; and Canyon Creek southwest of Lander, Fremont County Aug. 11-15, 1980-83, 4m2f in Scott coll. (these two sites average ~2 lunules in males and ~2/3 orange upf on females). And *L. f. florus* also occurs in the Front Range of Colorado where males average 1.9 lunules and females are completely brown to completely orange and average nearly 1/2 orange (Scott 2008). Farther south, *L. f. sangremar* Scott (Scott 2008) from southern Colorado-northern New Mexico averages 3.1 orange lunules on the hindwing of males and more than ~1/2 orange areas on female upf. Finally, the Yukon *L. f. arcticus* Ferris has the most lunules of all, ~3-4 on males with quite orange females. (True *Lycaena dorcas* also occurs in Yukon, and in Alaska.) Scott thinks that *L. f. dospassosi* McDunnough from New Brunswick is also a ssp. of *L. florus*, because it is so nearly identical to *L. f. megaloceras* that if both were mixed together they could not be identified properly without looking at locality labels, and it is unlike *L. dorcas*.

Types of *L. florus caldera*. The holotype male has just a minuscule sliver of uph orange (Figs. 25-26), from type locality Wyoming, Teton County, TNP [=Grand Teton National Park] Deadmans Bar [~6850', along Snake River], Aug. 3, 1980 [K. Bagdonas] (deposited in CSUC). Many paratypes shown in Figs. 27-34 with locality and date and repository listed in those figure legends. Other paratypes are listed below in Kondla and Scott collections.

Range of *L. florus caldera*. It occurs in Yellowstone and Grand Teton National Parks and the immediate high mountains (Figs. 27-28), eastward in the Absaroka Range and Gros Ventre Mountains and beside the Beartooth Plateau in Wyoming-Montana (Figs. 29-30, 32-34). It also occurs southward into the Wyoming Range/Salt River Range in Lincoln County, Wyoming, based on the following specimens: one male with only one orange dot shown in Fig. 31 (from Cottonwood Lake road east of Smoot ~7200', Lincoln County, Wyoming July 1, 1973 L. P. Grey, in Kondla coll.); the 6 dark females with small orangish (creamy on the worn female due to wing wear) markings shown in Fig. 32; one worn male from there with 2 orange lunules (all from Salt River Pass, 7630', Lincoln County, 1982, N. Kondla); plus 3m4f from 2 mi. south of Allred Flat Cgd. ~6900', Lincoln County July 25, 1964 J. Scott that are dark but a little more orange (3m that have 1 orange dot, 2 weak lunules, and 3 weak lunules, 4f with 1/5, 1/3, 1/3, and 1/2 orange dorsal fw, in Scott coll.). The Wasatch and Uinta Mountains in Utah evidently also have subspecies *caldera*, as the few we have seen have very little orange (2m with 0 and 1/2 lunule, 1f with only a tiny trace of several paler spots on the nearly-uniform brown upperside). The Jarbidge Mountains in Elko County in northeastern Nevada evidently also has *caldera*, as 1m1f are very dark (Pine Creek Cgd. road near Jarbidge, July 16, 1972 L. P. Grey, 1m no orange, 1f 1/5 orange upf, in Scott coll.). (The Ruby Mountains of Elko County butterflies that Scott (2008 p. 50) treated as *L. florus* he now considers to be *L. helloides* as they all have 3-4 orange lunules {Thomas Crk. Cgd., July 8, 1972 L. P. Grey 2m, Aug. 5, 1974 J. Scott 5m, Aug. 26 1966, J. Scott 1m}).



Figs. 25 (dorsal) and 26 (ventral). Holotype male *Lycaena florus caldera*, Wyoming Teton Co. TNP [=Grand Teton Nat. Park] Deadmans Bar, Aug. 3, 1980 [K. Bagdonas], in CSUC.



Fig. 27. *Lycaena florus caldera* paratypes: male Wyoming Teton Co. Turpin Meadows [6936', along Buffalo Fork], Aug. 16, 1980, K. Bagdonas; male MT Gallatin Co., Gallatin NF, Gallatin Range, Aug. 8, 2004 Paul & Evi Opler; male Wyoming, Fremont Co., Mackenzie Highland Ranch, 8975', 18 mi. northwest Dubois, 3945 US Hwy. 26, no date [K. Bagdonas] (all in CSUC); 2 males 1 female Clear Creek near Slide Creek, Sublette Co. Wyoming Aug. 10, 1980 J. Scott, in Scott coll.; 1 female Brooks Lake, Fremont Co. Wyoming Aug. 21, 1960 J. Scott, in Scott coll.



Fig. 28. *Lycaena florus caldera* paratypes, all Wyoming, Teton Co., Grand Teton National Park: female Deadmans Bar, Aug. 3, 1980 [K. Bagdonas]; male 1 mi. south BC Bar Road Aug. 5, 1980 [K. Bagdonas]; male U.W.N.P.S.R.C. [=Univ. Wyoming National Park Service Research Center, at Moose, Teton County, Wyoming] July 29 1979 [K. Bagdonas]; male, UW-NPS-RC July 18 1979 [K. Bagdonas]; male Two Ocean [not Oceans] Lake [~6950', ~5 mi. northeast Moran] July 9 2000, P. Opler & E. Buckner; male Leech Lake trailhead, July 20 1999, P. Opler & E. Buckner; two males Lizard Crk. Cgd. [~6800', just north Jackson Lake], Aug. 8, 1998, P. Opler (all specimens in CSUC).

Fig. 29. *L. f. caldera* paratypes: 9m Dead Indian Hill, 8673', Park Co., Wyoming, N. Kondla (in Kondla coll.).



Fig. 30. *Lycaena florus caldera* paratypes: 4m, Carbon Co., Montana, N. Kondla (in Kondla coll.).



Fig. 31. *Lycaena florus caldera* paratype: 1m Cottonwood Lake road east of Smoot ~7200', Lincoln Co., Wyoming, July 1, 1973 L. P. Grey (in Kondla coll.).

Fig. 32. *Lycaena florus caldera* paratypes: 6f (left & middle columns) Salt River Pass 7630', Lincoln Co., Wyoming; 2f (right column) Dead Indian Hill, 8673', Park Co., Wyoming (all in Kondla coll.)

Fig. 33. *Lycaena florus caldera* paratype male Granite Crk., Teton Co., Wyoming, July 14, 1976 L. P. Grey, in Kondla coll.

Fig. 34. *Lycaena florus caldera* paratypes: 4m2f Granite Creek, Gros Ventre Mountains, ~6600', Teton Co. Wyoming July 7, 2016, R. Romeyn coll.



Fig. 35. *Lycaena florus florus* 25m from Alberta, Canada, most from Waterton near type locality, a few from Calgary, in CNC (very fresh males reflect violet, which soon disappears but the wings of older males still reflect ultraviolet).



Fig. 36. *Lycaena helloides* from Teton Co., Wyoming (in CSUC), often sympatric with *L. f. caldera*. Label data in sequence from left to right, top to bottom: male Wyoming, Teton Co., TNP [=Grand Teton Nat. Park], below Jackson Lake Dam vii-19-2010 P. A. Opler; male Wyoming, Teton Co., TNP, 1 mi. southwest BC BAR BC 5 Aug. 1981 [K. Bagdonas]; male Wyoming, Teton Co., TNP, UW-NPS-RC [Univ. Wyoming National Park Service Research Center, at Moose, Wyoming] 31 July 1979 [K. Bagdonas]; female Wyoming Teton Co., TNP, 1 mi. south BC BAR BC 5 August 1980 [K. Bagdonas]; two females nr. Grand Teton National Park, Teton Co., Wyoming, 11 Aug. 1981 Scott Stanford; female Rockefeller Mem[orial].

Pkwy., 4 mi. south Yellowstone entr[ance]. [in TNP] ix-26-2010 P. M. & E. M. Opler; female Wyoming, Teton Co., TNP, Willow Flats 1 Aug. 1980 [K. Bagdonas]; two females Wyoming, Teton Co., [Bridger-Teton National Forest], Turpin Meadows 16-viii-80 [K. Bagdonas].

Lycaena florus caldera paratypes in University of Colorado Museum (CU) and the collections of N. Kondla and J. Scott, and non-paratype internet photos: Yellowstone Nat. Park, [Wyoming], July 22, 1937, W. Burdick, 5m (0, ½, 3 weak, ½, 1 lunules)(CU). Brooks Lake, east of Togwotee Pass, 9100', Fremont Co., Wyoming, July 21, 1960, J. Scott, 1f upf 1/10 orange (paratype, in Scott coll., Fig. 27). Mackenzie Highland Ranch, 8100', 18 mi. west Dubois, Route 283, Wind R. Mts., Fremont Co., Wyoming, Aug. 13, 1999, Reed A. Watkins, 2m (1/3, 2 weak lunules), 2f (upf 1/3, 2/3 orange)(CU). Clear Creek (at Slide Creek to 1 mi. upstream), 8600', Wind River Mts., Sublette Co., Wyoming, Aug. 10, 1980, J. Scott (Scott coll.), 8m (males ½, 1, ½, ½, ½, 1, 1, ½ lunules) 1f upf ¼ orange (2m1f are in Fig. 27). ~2 mi. northwest Warm Spring Mtn. [at DuNoir], 8400', Wind R. Mts., Fremont Co., Wyoming, Aug. 13, 1999, Reed A. Watkins, 1m 0 lunules, 1f 4/5 cream upf (CU). Dead Indian Hill, 8673', Absaroka Range, Park Co., Wyoming, 1982, N. Kondla, photo of 9m2f (Kondla coll., of the 9m in Fig. 29, 7m have ½ and 2m have several lunules, 2f in Fig. 32 have just weak postmedian paler spots). Carbon Co., Montana, 1982, N. Kondla, 4m in Fig. 30 all with 0 lunules. Internet photos (not paratypes) at <http://butterfliesofamerica.com/>: West Thumb, Yellowstone NP, Teton Co. July 27, 2009 1m two weak lunules, same site July 31, 2009 1m one tiny orange dot (this male was on white *Achillea lanulosa* flower); Blacktail Deer Plateau, Yellowstone National Park, Park County, Aug. 28, 2009, 1f 1/3 orange upf, 1f ¼ orange upf; Moose Crk., Teton Co., July 16, 2012 1f ¼ orange upf.

Lycaena florus caldera hostplants. Larvae eat *Vaccinium* based on numerous eggs found by Clyde F. Gillette (personal communication) on the following plants, including some Utah eggs he reared: on *V. cespitosum* and *V. scoparium* in Fremont County, Idaho, Oct. 3-4, 1996; on *Vaccinium cespitosum*, *V. scoparium*, and *V. membranaceum* in Wasatch County, Utah; on *V. scoparium* in Summit County, Utah; and on *Vaccinium* unstated species in Duchesne County, Utah.

Speculated origin of *L. f. caldera*. It is interesting that the darkest least-orange subspecies in the overall range of *L. florus* is *L. f. caldera*, and proceeding northward *L. f. megaloceras* has the orange (cream in females) markings a little more extensive (*L. f. megaloceras* is distinguished by cream-upperside females), and farther north *L. f. florus* has even more orange, and the northernmost Yukon taxon *L. f. arcticus* has the most orange. And proceeding south of *L. f. caldera*, *L. f. florus* has more orange, and *L. f. sangremar* in New Mexico has nearly as much orange as *L. f. arcticus*. The reason for this peculiar geographic “caldera bullseye” (a dark center surrounded by progressively more orange as one goes north or south) is unknown, but we can speculate that the ash blasting out of the Yellowstone caldera in all the major and some minor eruptions frequently coated the soil with dark ash, and then darker butterflies (especially females, because females with very orange forewing are quite conspicuous when basking with wings spread) were better camouflaged, and the ash was therefore so extensive that plants took a long time to recover. But if plants recovered soon and turned the landscape green, some other guess might be more correct. Among the three butterflies that have similar caldera ranges, *Coenonympha haydeni* is mostly black, but the other similar-range species *Boloria kriemhild* and *Euphydryas gillettii* are not darker than their relatives. *Argynnis hesperis* displays a similar “caldera bullseye” because the unsilvered-adult subspecies in the middle of the overall range have mostly-black larvae in the same range (the extra black pigment of larvae is hypothesized to carry over to the adult wing spots where the dark pigment evidently makes the spots cream which blocks the light from going farther into the scale then diffracting outward in a silver photon spectrum—silver spots evidently have a translucent area rather than cream pigment) (Scott et al. 1998); maybe the blackish larvae were better camouflaged on dark volcanic ash. Anyway this is doubtful speculation, but is interesting.

***Lycaena heteronea* Blue Females (Lycaenidae)**

by James A. Scott

Abstract. The distribution of blue females of *Lycaena heteronea* in western U.S. is detailed and discussed.

Lycaena heteronea clara H. Edwards has all females blue on upperside, roughly 50% as densely-blue as the completely-blue males. It ranges from the Tehachapi Mountains to Mt. Pinos in southern California. But similar blue females are rare in the rest of the range of *L. heteronea* Boisduval. I found four in Colorado in *L. h. heteronea* at a subalpine locality near the Eisenhower Tunnel in Summit County, where only ~3% of females are mostly blue, and found another mostly-blue female at the upper-montane east portal Moffat Tunnel, Gilpin County, Colorado, Aug. 4, 1977 (on *Eriogonum subalpinum* at both locales), where Ray E. Stanford caught two blue females August 21, 1968 (in CSUC, one figured by Fisher 2009). I had thought that the blue form “clara” was limited to the subalpine zone. But other females found at CSUC prove that it is present but rare at high and lower altitudes evidently throughout the range of *L. heteronea*, although it may be a little more common at high altitude.

Most of the records of blue females are from Colorado, but several are from California and Wyoming. Female *L. h. heteronea* form clara specimens (all in CSUC unless noted otherwise): Rabbit Ears Pass, Routt County, Colorado July 26, 1973 R. G. Simpson 1f; North Dunes State Wildlife Area, Jackson County, Colorado, July 21, 2001, P. A. & E. Buckner 1f; 4 miles northwest Hayden, Routt Co., Colorado, July 10, 1972 J. A. Scott 1f; east slope Kearsarge Pass, ~9800', Inyo County, California, Sept. 8, 1978 R. W. Holland 1f; Monitor Pass, Alpine County, California August 9, 2004 (photo at <http://butterfliesofamerica.com/>) 1f. *L. h. gravenotata* Klots specimens: Stuck Creek Road near Hohnholz State Wildlife Area, 8100', Larimer County, Colorado July 30, 1996, R. E. Stanford 1f; 25 miles W Cheyenne, Larimer County July 13, 1985 P. A. Opler 2f.

In a population named *L. h. northi* J. Emmel & G. Pratt, females are claimed to be usually blue, but a female *northi* type specimen from North Trinity Mtn., trail to Water Dog Lakes, 5800', North Trinity Mtn., Humboldt Co. California Aug. 12, 1990 (photo at <http://butterfliesofamerica.com/>) is blue only on dorsal forewing, and a female reared from that locale is the same; perhaps modifier genes have prevented blue from being expressed on the uph in females of that taxon. But a female *L. h. heteronea* from Granite Creek, Teton County, Wyoming, July 9, 1979 is also blue only on upf. Such modifier genes may be widespread; that blue-forewing-only form evidently differs genetically from the usual blue form, which has blue more extensive on hindwing than forewing (the marginal area of upf is generally brown not blue on all of the blue females).

Lycaena heteronea and *L. rubidus* (Behr) have been the subjects of several good studies on butterfly vision. *L. heteronea* has bright blue ups of males but females are usually brown, while *L. rubidus* is very closely related but has orange-red ups of males and females are variably brown to mostly orange. The two species also have differing mate-locating systems. *L. heteronea* males fleck (defined by Scott 2010 as flying “patrolling” to actively seek females) and sometimes rait (defined as the male resting “perching” to wait for females to arrive), whereas *L. rubidus* males usually rait and sometimes flait (defined as flying about a small area to wait for females to arrive) to find them. These two species are adapted to desire different colors, and they use those colors in different ways. Bernard & Remington (1991) and Sison-Mangus et al. (2006) found that both species have optical receptors peaking at ultraviolet 360nm, blue 437nm, green 500nm, and yellow-red 568nm, the latter useful for detecting reddish butterflies and hostplants (the same wavelength used in human red cone light detectors). But the placement of some of these detectors differs between *heteronea* and *rubidus* and differs between sexes and differs on top versus bottom of the eye, according to their function in detecting mates and detecting oviposition sites. Evidently the males do not care about the color of females very much, especially in *L. rubidus*, because the females vary greatly in color from orange to brown yet they efficiently find mates (Bernard & Remington 1991 state that virgin *L. heteronea* females produce a pheromone and the male is

In North Dakota, the photo of *Callophrys gryneus siva* female from Slope Co. illustrated in Royer (2003) has an offset unh line, so that individual may have ancestors that interbred with ssp. *gryneus*.

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Callophrys sheridanii sheridanii Ventral Hindwing Postbasal Spots (Lycaenidae)

Abstract. White postbasal marks on the ventral hindwing of *Callophrys sheridanii sheridanii* were found to be widespread geographically. Their mysterious origin is hypothesized.

Scott and Fisher looked in available collections and found that many specimens of ssp. *sheridanii* from the northwestern Colorado mountains have a tiny to several-mm-long white postbasal mark on ventral hindwing. In Grand County a slight majority have a minuscule postbasal dot or a longer mark (often two-parted), and they also are common in Gunnison County (just south Crested Butte, M. Fisher, and among six specimens in the CSUC from Brush Creek four have a tiny white dot, one has a 3mm stripe, and one has none). The spots are also common in Summit County and Eagle County (one of three has a tiny spot). One was found on Dory Hill in Gilpin County. Four specimens with white marks are from Pole Mountain in Albany County, Wyoming. This makes it seem that the postbasal marks only occur in higher-mountain populations.

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***Celastrina lucia lumarco* in the Chuska Mountains, and other
Celastrina in New Mexico (Lycaenidae)**

by James A. Scott

Abstract. *Celastrina lucia lumarco* is reported from the Chuska Mountains, New Mexico-Arizona, and its relationship with *C. echo cinerea* and *C. lucia sidara* is discussed.

I named *Celastrina lucia lumarco* Scott (2006) from butterflies on the western slope of the Colorado mountains (in Delta, La Plata, and Archuleta Counties), which have enlarged brown markings on the underside, always or nearly-always including brown marginal markings, and very often (~50%) including a large brown patch on middle of hindwing (adults with just strong marginal brown markings are form *marginata*, those with both strong marginal markings and a brown central patch are form *lucimargina*, while those that have just the central patch are form *lucia*, which is rare in *lumarco*). Since then *lumarco* has also been found (in specimens in CSUC and Scott collections) all over the western Colorado mountains, in Routt, Grand, Garfield, Mesa, Montrose, and Gunnison Counties, and in Rio Arriba County, New Mexico (1.5 mi. south Dulce Lake, west of Hwy. 64, 7400', May 10, 1983, Ray E. Stanford).

C. l. lumarco seems to be quite distinctive from other *Celastrina* because the brown central patch is so large on unh, thus it may prove to be a distinctive taxon, especially compared to some other "species" in this difficult genus, which cannot be identified without using the locality and rearing them from known hostplants, and may actually be "hostplant races" like those in *Euphilotes* (Lycaenidae).

C. l. lumarco hostplants: The hostplant in Garfield County, Colorado (No Name Creek, Grizzly Creek, etc.) is *Cornus sericea* (and not *Prunus virginiana* or *Amelanchier alnifolia* which are also common there), based on multiple oviposition and eggs that I found and reared on *C. sericea*. There are photos of egg and oviposition on *Ceanothus velutinus* from Vasquez Mountains (just northwest of Berthoud Pass, barely onto the western slope), Grand County Colorado June 25, 2009 at <http://butterfliesofamerica.com/>, but the adults shown from there seem to have slightly less unh brown markings than regular *lumarco* so may have intergraded with *C. lucia sidara* (Clench).

The population most similar to *lumarco* northward seems to be the "*Celastrina lucia*" variety found in Cowiche Canyon, NE of Yakima, Yakima Co. Washington, which often has a huge brown central unh patch. At that locality James & Nunnallee (2011) found its hostplant to be *Cornus sericea* also, and reared it on that plant and illustrated the early stages. I have seen some other adults with the giant *lucia* patch from the Glacier National Park area in Montana, the Yellowstone area of Wyoming, and on the Pine Ridge of northwestern Nebraska, which are presumed to be variants of *C. lucia*, but their exact identity and relationship to *lumarco* is uncertain.

Here I report Richard W. Holland's surprising discovery of *lumarco* in the Chuska Mountains of Arizona-New Mexico (Figs. 42-43)--surprising because those mountains usually have butterflies that are more closely related to taxa from the south (Holland, 2009) (for instance, the Chuska Mountains has *Callophrys dumetorum* near-*apama* (W. H. Edwards) as does the Zuni and Jemez Mountains, and the Chuska Mountains has *Argynnis hesperis dorothea* Moeck as does the Sandia and Manzano Mountains and Mt. Taylor). *C. l. lumarco* seems to be widespread in the upper parts of the Chuska Mountains, from 7000-9000', specifically from Wagon Wheel Campground, Lukachukai Creek Picnic Ground and Campground and Pass, 2 mi. south & southwest of Cove, Washington Pass, FAA Tower 9000', and 3 mi. north Buffalo Pass (all specimens in CSUC), from May 14-June 17 (mostly May 14-early June). About eight specimens have a fairly-large central brown patch, though none have the gigantic brown patch that occurs fairly frequently in western Colorado (in Colorado only about 50% of *lumarco* have the central patch of form *lucimargina*, while the other 50% are just form *marginata* with just the enlarged marginal brown markings). All the Chuska Mountains *lumarco* have browner marginal markings. Thus they do not have quite as much brown markings on underside as in the rest of the *lumarco* range, though the worn

condition of many specimens surely makes them look less well-marked than if they were fresh and more contrastingly patterned.

The lower row in figs. 42-43 depicts adults from the Carrizo Mountains (Bedrock Spring in Toh Chin Lin Canyon, 2280m, Apache County, Arizona, April 30, 2001, R. W. Holland), which is a very small lower-altitude mountain range just north of the Chuska Mountains; those look like *Celastrina echo* near *cinerea* (W. H. Edwards), as the marginal markings are not browner and only 3 males have a small central lucia patch, which looks like the small patch found on several percent of adults of *Celastrina echo sidara* on the eastern slope of the Front Range in Colorado. This series does have those three males with small *lucia* patches, however, suggesting the possibility that they are intermediates resulting from intergradation between *C. echo cinerea* (found in most of New Mexico) and *lumarco*, which if it occurs suggests that *lumarco* is just a subspecies of *C. echo*.

But that hypothesized intergradation is contradicted by the identification of some Chuska Mountains specimens as *C. echo cinerea*, a paler subspecies that generally lacks darker brown markings, suggesting that there may be two species present there. These are from near Toadlena 6800-7200', San Juan County, New Mexico April 30 1994 R. E. Stanford, two males with white uns; above Cove on road to Lukachukai, 7000', Apache County, Arizona July 23, 1978 R. W. Holland, one male; and Lukachukai Cgd. 7000', Chuska Mountains, Apache County, Arizona, May 14, 1971, R. W. Holland, one female. These specimens represent several generations, with the first generation partly overlapping *C. l. lumarco*, and *C. e. cinerea* always has multiple generations whereas *lumarco* is not known to have more than one. This suggests that they may be different species.

Actually, the slightly-lesser amount of brown markings on unh of Chuska Mts. *lumarco* and Grand County Colorado *lumarco* may suggest that *lumarco* and *C. l. sidara* are conspecific and intergrade somewhat.





Figs. 42 (mostly dorsal)-43 (opposite wing surface). *Celastrina lucia lumarco* from Chuska Mountains 15m6f (top four rows of each figure) and *Celastrina echo* near *cinerea* 4m2f from Carrizo Mtns. just to the north (bottom row).

Celastrina echo cinerea is widespread in New Mexico, occurring nearly everywhere above the deserts and prairies, in several generations of rather whitish-underside butterflies with no extra brown ventral markings. One later generation *cinerea* female in CSUC is from Clayton above the dam, 5200', Union County, New Mexico Aug. 4, 1997, R. W. Holland, although this female may actually be *Celastrina neglecta* (W. H. Edwards), an eastern North American butterfly, as the two are difficult to distinguish.

But adults I have identified as the darker-overall *C. "lucia" sidara* (which occurs on the eastern slope of the Colorado mountains) occur in the boreal northern New Mexico mountains. The following are *C. l. sidara* which are sometimes sympatric with *C. e. cinerea* as noted below: 4 mi. north El Rito, Arroyo Seco, Rio Arriba County, New Mexico 7600', May 14, 1978 Glenn R. Scott 1m; Flechado Campground, 8000', Route 3, Taos County, New Mexico May 15, 1985 R. Stanford 3m; 1 mi. southeast of Ledoux, Hwy. 94, 7600', Mora County, New Mexico May 15, 1985 Ray Stanford 1m (I identified *C. e. cinerea* from Coco City west of Abuelo, 7550', Santiago Creek, Mora County August 25, 1978 1m); near Rociada Creek, 8000', San Miguel County, New Mexico R. E. Stanford May 2, 1970 1m, May 3, 1970 1f (I identified *C. e. cinerea* from Rociada Aug. 23, 1978 1f, and from Beulah, Sapello Canyon, San Miguel County, August 24, 1978 1f, and from Tecolote Creek, San Miguel County, September 10, 1978 1m); Big Arsenic Spring, Rio Grande gorge, Taos County 7000', May 9, 1985 R. W. Holland, 2m; north side San Francisco Pass north of Sugarite Canyon State Park, Las Animas County, Colorado June 29, 1997 2m (all in CSUC or Scott collections). These and widespread Colorado *sidara* are darker than *C. echo cinerea* and seem to be univoltine. Perhaps further research may confirm that *sidara* is basically just a spring generation of multivoltine *cinerea* and in Colorado a univoltine variety of *cinerea*. Note that the *cinerea* specimens in this paragraph were collected L Aug.-M Sept. which suggests that those might just be a later generation descending from spring *sidara*. However, mid May to L Aug.-M Sept. is too long between generations for rapidly growing *Celastrina* immatures, suggesting that there may be a June brood of whitish-uns *cinerea* that has not been collected yet, therefore *cinerea* may fly June and L Aug.-M Sept. there. In the lab, my rearings of Colorado Front Range *sidara* did not produce whitish adults that could be called *cinerea* (Scott 1998) which suggests that they are different species; but possibly? the

